



**SUMMER STEELHEAD STOCK COMPOSITION IN COLUMBIA  
RIVER AND LOWER SNAKE RIVER SPORT FISHERIES AND  
THE COLUMBIA RIVER CATHLAMET CHANNEL POUND NET**

**JUNE 16, 2020 to DECEMBER 31, 2020**

**Prepared by:**

**Alan Byrne, Idaho Department of Fish and Game  
Thomas Delomas, Pacific States Marine Fisheries Commission  
Ken Keller, Pacific States Marine Fisheries Commission  
Bonnie Jackman, Pacific States Marine Fisheries Commission  
Jeremy Trump, Washington Department of Fish and Wildlife**

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Alan Byrne<sup>a</sup>, Thomas Delomas<sup>b</sup>, Ken Keller<sup>c</sup>, Bonnie Jackman<sup>c</sup>, Jeremy Trump<sup>d</sup>

<sup>a</sup> Idaho Department of Fish and Game  
600 South Walnut Street  
Boise, ID 83707

<sup>b</sup> Pacific States Marine Fisheries Commission  
Eagle Genetics Lab  
1800 Trout Road  
Eagle, ID 83616

<sup>c</sup> Pacific States Marine Fisheries Commission  
5525 South 11th Street  
Ridgefield, WA 98642

<sup>d</sup> Washington Department of Fish and Game  
529 West Main Street  
Dayton, WA 99328

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	vi
ABBREVIATIONS AND ACRONYMS .....	vii
ABSTRACT.....	1
INTRODUCTION .....	2
METHODS.....	3
Steelhead Passage at Bonneville Dam .....	3
Steelhead Run-Timing at Bonneville Dam.....	4
Lower Columbia River Sport Harvest Estimates.....	4
Lower Snake River Sport Harvest Estimates.....	5
Sample Collection in the Lower Columbia River Sport Fishery.....	5
Sample collection from the Columbia River Cathlamet Channel Pound Net .....	5
Sample Collection in the Lower Snake River Fishery .....	6
Estimating Composition Proportions .....	6
Confidence Intervals for Group, Stock, and Basin Proportions .....	7
Ocean Age and Length Percentages .....	7
RESULTS .....	9
Steelhead Passage at Bonneville Dam .....	9
Steelhead Run-Timing at Bonneville Dam.....	10
Lower Columbia River Sport Harvest Estimate.....	10
Lower Snake River Sport Harvest Estimate .....	10
Estimating Composition Proportions And Harvest Contribution .....	10
Lower Columbia River Sport.....	10
Pound Net .....	11
Lower Snake River sport.....	12
DISCUSSION.....	12
REFERENCES .....	15

## LIST OF TABLES

Table 1.	All distinct PBT release groups with their stock assignment, basin assignment, brood year (BY), and tagrate that were sampled in the Lower Columbia River sport fishery from June 16 to July 31, 2020. The GSI stock assignment was used for fish that were not assigned to a PBT release group. ....	17
Table 2.	Stock composition and harvest estimates by stock and brood year (BY) in the Lower Columbia sport fishery, June 16 to July 31, 2020. All fish were adipose clipped. The GSI assignment was used for fish that did not assigned to a PBT release group. ....	18
Table 3.	Stock composition and harvest estimates by stock in the Lower Columbia sport fishery, June 16 to July 31, 2020. All fish were adipose clipped. The GSI assignment was used for fish that did not assigned to a PBT release group. Stock estimates may not equal the sum of their BY components due to rounding error. ....	20

Table 4.	The number of all fish and large fish sampled by stock and the maximum likelihood (ML) estimate of the percentage of the large fish from each stock and the percentage of fish within each stock that were large that were sampled in the Lower Columbia River sport fishery from June 16 to July 31, 2020.....	21
Table 5.	All distinct PBT release groups with their stock assignment, basin assignment, brood year (BY), and tagrate that were sampled in the Pound Net from August 26 to October 9, 2020. The GSI stock assignment was used for fish that were not assigned to a PBT release group.....	22
Table 6.	The percentage of clipped hatchery origin fish by stock and brood year (BY) using all clipped and unclipped sampled fish (Percent by stock/BY –all) and the group’s percentage of the hatchery clipped fish (Percent of H) sampled in the Pound Net, August 26 to October 9, 2020. ....	24
Table 7.	The percentage of clipped hatchery origin fish by stock using all clipped and unclipped sampled fish (Percent by stock –all) and the percent of 1-ocean fish in each clipped PBT assigned stock from the Pound Net, August 26 to October 9, 2020. Stock estimates may not equal the sum of their BY components due to rounding error. ....	26
Table 8.	The number of all clipped fish and large clipped fish sampled by stock and the maximum likelihood (ML) estimate of the percentage of the large fish from each stock and the percentage of fish within each stock that were large that were collected in the Pound Net, August 26 to October 9, 2020. ....	27
Table 9.	The percentage of unclipped hatchery origin fish (HNC) by stock and brood year (BY) and the percentage of unclipped wild origin fish by stock using all clipped and unclipped sampled fish (Percent by stock/BY –all) and the group’s percentage of the hatchery unclipped fish (Percent of HNC) and wild fish (Percent of W) sampled in the Pound Net, August 26 to October 9, 2020.....	28
Table 10.	The number of all unclipped fish and large unclipped fish sampled by stock and the maximum likelihood (ML) estimate of the percentage of the large fish from each stock and the percentage of fish within each stock that were large that were collected in the Pound Net. All fish were collected from August 26 to October 9, 2020. ....	29
Table 11.	All distinct PBT release groups with their stock assignment, basin assignment, brood year (BY), and tagrate that were sampled in the Lower Snake River sport fishery from September 1 to December 31, 2020. The GSI stock assignment was used for fish that were not assigned to a PBT release group.....	30
Table 12.	Stock composition estimates by stock and brood year (BY) in the Lower Snake River sport fishery from September 1 to December 31, 2020. All fish were adipose clipped. The GSI assignment was used for fish that did not assigned to a PBT release group. ....	31
Table 13.	Stock composition estimates in the Lower Snake River sport fishery, September 1 to December 31, 2020. The GSI assignment was used for fish that did not assigned to a PBT release group. Stock estimates may not equal the sum of their BY components due to rounding error.....	32
Table 14	The number of all fish and large fish sampled by stock and the maximum likelihood (ML) estimate of the percentage of the large fish from each stock	

and the percentage of fish within each stock that were large that were sampled in the Lower Snake River sport fishery from September 1 to December 31, 2020. ....33

## LIST OF FIGURES

Figure 1.	Map of the Lower Columbia River showing the 10 creel survey sections that were used to estimate sport harvest.....	34
Figure 2.	Washington Department of Fish and Wildlife harvest zones in the Snake and Walla Walla basins that are used to estimate steelhead harvest. ....	35
Figure 3.	Map of the GSI reporting groups that were developed by CRITFC. These groups were used to assign adipose clipped and adipose unclipped steelhead that were not identified with PBT.....	36
Figure 4	Run-timing of fall Chinook and hatchery and wild steelhead stocks at Bonneville Dam in 2020. The Skamania stock is for fish released in the Klickitat River. The Snake River wild stock excludes fish tagged at Snake River dams.....	37
Figure 5.	Hatchery stock composition in the Lower Columbia River sport fishery, June 16 to July 31, 2020.....	38
Figure 6.	Harvest contribution by basin in the Lower Columbia River sport fishery, June 16 to July 31, 2020.....	38
Figure 7.	The percentage and 90% confidence intervals of clipped hatchery (H), unclipped hatchery (HNC), and unclipped wild origin fish sampled in the Pound Net in 2020. ....	39
Figure 8.	Stock composition of clipped hatchery origin fish sampled in the Pound Net in 2020. Clipped hatchery origin fish made up 67% of the sampled fish. ....	39
Figure 9.	Stock contribution by basin of the clipped hatchery origin fish sampled in the Pound net in 2020.....	40
Figure 10.	Stock composition of unclipped fish sampled in the Pound Net in 2020. Unclipped hatchery origin (HNC) and wild fish made up 14% and 19% of the sampled fish, respectively. ....	40
Figure 11.	The percentage by basin of wild steelhead that were sampled in the Pound Net in 2020. Wild steelhead made up 19% of the total fish sampled. ....	41
Figure 12.	Hatchery stock composition in the Lower Snake River sport fishery, September 1 to December 31, 2020. ....	41

## LIST OF APPENDICES

Appendix A.	Date of arrival at Bonneville Dam of summer steelhead stocks and fall Chinook in 2020. The Pound Net passage column is the percentage of the stock's passage that occurred at Bonneville Dam from August 28 to October 9, 2020. The stocks shaded in grey contribute most of the large hatchery origin steelhead during the A/B-Index steelhead passage period at Bonneville Dam.....	42
Appendix B.	Harvest and stock composition estimates by PBT release groups in the Lower Columbia River sport fishery, June 16 to July 31, 2020. All fish were adipose clipped.....	43
Appendix C	PBT release group percentages of all fish sampled in the Columbia River Pound Net in 2020. The classification (Class) is based on the adipose fin of the sampled fish and the genetic analysis not the adipose status of its PBT release group. Class H = adipose clipped hatchery origin; HNC adipose unclipped hatchery origin; W = adipose unclipped wild origin. ....	44
Appendix D.	PBT Release group percentages for the Lower Snake Sport 2020 fishery. Harvest estimates were not available at the time the report was compiled. All fish were adipose clipped.....	46

## **ACKNOWLEDGEMENTS**

This report categorizes the stock composition of the summer steelhead sport harvest in the Columbia River downstream of Bonneville Dam, the Snake River from its mouth to the Idaho/Washington border, and steelhead collected at the Columbia River Cathlamet Channel Pound near river kilometer 67 in 2020. It was a cooperative effort among the Idaho Department of Fish and Game, Washington Department of Fish and Wildlife, and the Pacific States Marine Fish Commission. The authors wish to acknowledge the assistance of staff from all agencies that collected and genotyped the samples. The report that follows is a multi-agency product under the technical lead of Alan Byrne.

## ABBREVIATIONS AND ACRONYMS

BON	Bonneville Dam
BWSALM	Big White Salmon River GSI reporting group
BY	Brood Year
CIs	Confidence Intervals
CRITFC	Columbia River Inter-Tribal Fish Commission
GSI	Genetic Stock Identification
IDFG	Idaho Department of Fish and Game
KLICKR	Klickitat River GSI reporting group
LOWCOL	Lower Columbia River GSI reporting group
lci	Lower Confidence Interval
MFSALM	Middle Fork Salmon River GSI reporting group
MGILCS	Mid-Columbia-Grande Ronde-Imnaha-Lower Snake-Lower Clearwater-Lower Salmon GSI reporting group
ODFW	Oregon Department of Fish and Wildlife
PBT	Parentage Based Tagging
PIT	Passive Integrated Transponder
SFCLWR	South Fork Clearwater River GSI reporting group
SFSALM	South Fork Salmon River GSI reporting group
SKAMAN	Skamania GSI reporting group
TAC	<i>U.S. v Oregon</i> Technical Advisory Committee
uci	Upper Confidence Interval
UPCLWR	Upper Clearwater (Lochsa River and Selway River) GSI reporting group
UPPCOL	Upper Columbia River GSI reporting group
UPSALM	Upper Salmon River GSI reporting group
WILLAM	Willamette River GSI reporting group
WDFW	Washington Department of Fish and Wildlife
YAKIMA	Yakima River GSI reporting group



## **ABSTRACT**

The summer steelhead passage at Bonneville Dam in 2020 during the A/B-Index counting period was 107,591. This was the third lowest return since 1990 but was an increase from the previous two years. The low return of steelhead caused sport fisheries in the Columbia River to be constrained with time and area closures and a reduced daily limit. Anglers could retain one clipped steelhead per day in the lower Columbia sport fishery until it was closed to harvest on August 1, 2020. The Snake River steelhead sport fishery downstream of the Idaho/Washington border was open from September 1 to December 31, 2020 with a reduced daily limit. We collected enough samples to make stock composition estimates, using genetic techniques, in the lower Columbia River sport fishery from June 16 to July 31, the lower Snake River sport fishery from September 1 to December 31, 2020, and for steelhead captured in the Columbia River Cathlamet Channel Pound Net from August 28 to October 9, 2020. Due to the COVID pandemic, tribal fisheries in Zone 6 were not sampled in 2020. Snake River basin hatchery stocks made up 45% of the Columbia River sport harvest downstream of Bonneville Dam and 100% of the Snake River sport harvest downstream of the Idaho/Washington border. Wild fish from the Snake basin made up nearly 13% of all steelhead sampled at the Pound Net. Snake River stocks made up 95% of the adipose clipped hatchery steelhead, 100% of the adipose unclipped hatchery steelhead, and 67% of the wild steelhead that were sampled in the Pound Net.

## INTRODUCTION

The run-timing of summer steelhead into the Columbia River overlaps the run-timing of spring, summer, and fall Chinook, sockeye, and to a lesser extent coho. Spring, summer, and fall Chinook are targeted by non-tribal commercial fisheries downstream of Bonneville Dam (BON), tribal commercial, ceremonial, and platform fisheries upstream of BON, and sport fisheries downstream and upstream of BON. All steelhead caught in non-tribal commercial fisheries must be released and only steelhead with a clipped adipose fin (hereafter referred to as clip or clipped) may be kept in sport fisheries. Steelhead, both clipped and those with an intact adipose fin (hereafter referred to as unclip or unclipped) may be retained in any tribal fishery. As defined in the *U.S. v Oregon Management Agreement*, Chinook fisheries in the Columbia River are managed for three time periods: Upriver spring and Snake River summer Chinook from January 1 to June 15; upper Columbia River summer Chinook from June 16 to July 31; and fall Chinook from August 1 to December 31. Steelhead run sizes, which are used to determine ESA and harvest impacts, are counted at BON during three time periods: winter run from November 1 to March 31, Skamania run from April 1 to June 30, and the Upriver A-Index and B-Index run from July 1 to October 31. A-Index fish are defined as steelhead < 78 cm and B-Index as steelhead  $\geq$  78 cm that pass BON from July 1 to October 31.

Steelhead harvest is estimated for all tribal and non-tribal fisheries. In sport fisheries, steelhead harvest is estimated in-season with creel surveys on a monthly basis in the lower Columbia River downstream of BON. Sport catch upstream of BON is estimated monthly from catch record cards and may not be available for several years. Sport steelhead harvest is reported as the number of fish kept. Preliminary steelhead and Chinook harvest estimates in the tribal Zone 6 fishery are made on a weekly basis beginning June 16. This allows managers to adjust seasons to keep steelhead impacts and harvest of summer and fall Chinook within the limits that are outlined in *U.S. v Oregon*. Final harvest estimates are reported by *U.S. v. Oregon* Technical Advisory Committee (TAC) at the conclusion of the tribal fishery. Tribal fall season steelhead harvest estimates are reported as the number of clipped and unclipped fish kept that were <78 cm (A-Index) and  $\geq$ 78 cm (B-Index).

All adipose clipped fish are known to be hatchery origin. Clipped hatchery fish from the Snake River and other hatcheries could be assigned to a hatchery stock and release group using Parentage Based Tagging (PBT) markers. Clipped steelhead that did not assign using PBT markers were a hatchery fish from an adult whose parents were not genotyped. These PBT unassigned hatchery origin fish were then assigned using Genetic Stock Identification (GSI) markers. Steelhead with an intact adipose fin could be a wild fish or hatchery origin fish released without a clipped adipose fin. Samples from unclipped steelhead GSI were analyzed using PBT markers to determine if the fish was hatchery origin. Unclipped samples that did not assign to a PBT hatchery release group (putative wild fish) were assigned to a Columbia River GSI reporting group. The GSI reporting groups outside of the Snake River basin were developed using wild and hatchery origin steelhead. GSI reporting groups that lie entirely within Idaho in the Snake River basin were developed using wild fish only.

Hatcheries in the Snake River basin release the majority of summer steelhead smolts in the Columbia River basin. Usually over 70% of the total basin smolt releases and about 85% of the smolts released upstream of BON are from Snake River basin hatcheries. The Idaho Department of Fish and Game (IDFG) began collecting genetic samples from hatchery steelhead used for broodstock starting with Brood Year (BY) 2008 at all hatcheries in Idaho. Beginning with BY2009 and continuing each year afterward, all hatchery steelhead used for broodstock in the Snake River basin have been sampled and genotyped by IDFG, Washington Department of Fish

and Wildlife (WDFW), and Oregon Department of Fish and Wildlife (ODFW). The Columbia River Inter-Tribal Fish Commission (CRITFC) has worked with managers to collect samples for genotyping from steelhead broodstock from non-Snake River hatcheries in the Columbia River beginning with BY2012. Currently, nearly all summer steelhead broodstock from hatcheries upstream of BON are genotyped and in the PBT database and their offspring can be identified with Parental Based Tagging (PBT) methods. Most summer steelhead used for broodstock in hatcheries downstream of BON are not genotyped.

The stock composition of summer steelhead in the Columbia River sport and tribal fisheries has been estimated since 2011 (Byrne et al. 2020, Byrne et al. 2018a, Byrne et al. 2018b, Byrne 2018c, Byrne et al. 2016, Byrne et al. 2015, Byrne et. al 2014a and Byrne et. al 2014b). Until this study was initiated, there were no estimates of the harvest contribution of hatchery and wild stocks in the tribal and non-tribal fisheries in the Columbia River. Summer steelhead stock composition of fish captured in the Cathlamet Pound Net has been estimated since 2017 (Byrne 2019 and Byrne and Delomas 2020). IDFG coordinated the sampling of steelhead harvested in the lower Columbia River sport fishery, the Snake River sport fishery downstream of the Idaho/Washington border, and steelhead sampled at the Columbia River Cathlamet Channel Pound Net in 2020. Due to COVID concerns the tribal fishery in Zone 6 was not sampled in 2020. The primary cooperators of this effort in 2020 were IDFG, WDFW, and the Pacific States Marine Fish Commission. All dates used in this report are for the year 2020 unless specified otherwise.

## **METHODS**

### **Steelhead Passage at Bonneville Dam**

The daily count of clipped and unclipped steelhead at BON from July 1 to October 31 was obtained from the Fish Passage Center's website (available at [https://www.fpc.org/webapps/adultsalmon/Q\\_adultcounts\\_dataquery.php](https://www.fpc.org/webapps/adultsalmon/Q_adultcounts_dataquery.php)). CRITFC personnel sampled steelhead at BON and recorded the fork length and the presence or absence of the adipose fin. Steelhead were designated in-season as hatchery or wild origin primarily based on the presence of a fin clip or an eroded dorsal fin. If either was observed, the default designation was hatchery and if both were absent, the default designation was wild origin. However, when aging scales a small proportion of unclipped fish initially categorized as wild were changed to hatchery origin if rapid freshwater scale growth was observed with the absence of any hard freshwater annuli checks (Jeff Fryer, CRITFC, personal communication). Beginning in 2011, CRITFC obtained tissue samples from all steelhead that were handled and used PBT post-season to determine if any unclipped fish were hatchery origin. If an unclipped fish that was visually called wild was later determined to be hatchery origin using genetic analysis, we classified that fish as unclipped hatchery origin. TAC used the post-season data to estimate the percentage of A-Index and B-Index hatchery fish of clipped steelhead and the percentage of A-Index and B-Index wild and hatchery fish using the unclipped samples. These percentages were estimated within 11 time strata in 2020. The clipped percentages were multiplied by the clipped steelhead dam count and the unclipped percentages were multiplied by the unclipped steelhead dam count in each strata to estimate the number of wild and clipped and unclipped hatchery origin A-Index and B-Index fish that passed the dam. The total A-Index and B-Index wild, clipped, and unclipped hatchery passage at BON was the sum of all time periods.

### **Steelhead Run-Timing at Bonneville Dam**

All hatchery summer steelhead stocks in the Snake River basin and several non-Snake hatchery stocks in the Columbia River are representatively Passive Integrated Transponder (PIT) tagged prior to release as smolts. Wild juvenile steelhead are also PIT-tagged throughout the Columbia River basin. We calculated the run timing of summer steelhead stocks passing BON in 2020 using the date of their first adult detection at BON. We obtained the daily number of adult summer steelhead detections at BON from April 1 to December 31 for wild and hatchery fish that were PIT-tagged upstream of BON except in the Snake River basin. For Snake basin fish we obtained all adult steelhead detections at BON from June 1 to December 31. There were no Snake basin adult steelhead detected at BON before June 1 from return year 2020. . The detection data was obtained from the PTAGIS website (<http://www.ptagis.org>). We only used the adult detection data of hatchery and wild summer steelhead that were tagged as juveniles before July 1, 2019 and were returning to spawn in the spring of 2021 (most summer steelhead that spawned in the spring of 2021 passed BON in 2020). Some of the adults were determined to be kelts or smolts based on their detection history at main stem dams and tributary PIT arrays and were removed from the analysis. Repeat spawners were not used to calculate run timing as only fish on their first adult migration upstream were included for the run-timing analysis. The run-timing of each Snake River hatchery stock, except the Dworshak and Wallowa, were calculated by combining detections from all of the stock's release groups and BYs. The Dworshak stock was split into two groups: fish reared at Dworshak or Clearwater hatcheries and released in the Clearwater drainage (Dwor-C) and those fish reared in the Hagerman Valley hatcheries and released in the Salmon drainage (Dwor-S). The parents of both Dwor-C and Dwor-S groups were trapped and spawned at Dworshak Hatchery. The Wallowa stock run-timing split into two stocks. Wallowa-OR were Wallowa smolts released in Oregon and Wallowa-WA were Wallowa smolts released in the Washington. All Wallowa-WA smolt releases were from broodstock collected at the Cottonwood Pond Adult Trap on the lower Grande Ronde River and reared at Lyons Ferry Hatchery. The Wallowa-OR smolt releases were from broodstock collected at Wallowa Hatchery and reared at Irrigon Hatchery. The Skamania stock run-timing was calculated using only fish that were released in the Klickitat River. The middle Columbia River (Mid-C) hatchery run-timing was calculated by combining detections of all non-Snake River summer steelhead hatchery stocks (except Skamania) and BYs released between BON upstream to and including the Yakima River basin. The upper Columbia River (Up-C) hatchery run-timing was calculated by combining detections of all summer steelhead hatchery stocks and BYs released upstream of the Yakima River. The run-timing of wild steelhead from the Mid-C (BON to Yakima River, excluding the Snake River basin), Up-C (all rivers upstream of the Yakima River), and Snake (excluding fish tagged at Snake River mainstem dams) regions was calculated by combining detections from all release sites in each region that were coded as summer run in the PTAGIS database. Fall Chinook run timing was calculated using the daily and cumulative adult window count at BON from August 1 to November 30. We estimated the cumulative passage proportion for each date of all wild and hatchery steelhead stocks and fall Chinook at BON. There were many fall Chinook salmon that spawned downstream of BON and these were not included in the fall Chinook run timing analysis.

### **Lower Columbia River Sport Harvest Estimates**

Sport anglers could retain one hatchery steelhead per day in the Columbia River from Buoy 10 to BON from June 16 to July 31, 2020. The steelhead fishery was closed and no retention allowed from August 1 to October 31, 2020.

The recreational sport fishery downstream of BON is divided into ten sampling sections. (Figure 1). Personnel from ODFW and WDFW conduct random angler interviews at their respective boat ramps, beaches, and on the river to determine catch rates for each species in each section. The total number of fish caught and released for each species, month, and section is estimated by combining total angler effort estimates derived from aerial surveys and bank angler counts with the observed angler catch rates in each section (Watts 2020 and TAC 2008). The steelhead sport harvest is not parsed into hatchery stocks by ODFW and WDFW. There was no catch quota on the harvest of clipped steelhead, however all non-tribal fisheries in the Columbia River from Buoy 10 upstream to the Highway 395 bridge near Pasco, Washington, must not exceed a 2% impact rate on wild A-run and 2% on wild B-run steelhead in July and an additional 2% impact on A-run and B-run fish from August 1 to December 31.

### **Lower Snake River Sport Harvest Estimates**

Sport anglers could retain one steelhead per day in the Snake River downstream of Lower Granite Dam and two per day from Lower Granite Dam to the Idaho/Washington border from September 1 to December 31, 2020. Only steelhead with a clipped adipose fin could be kept. The recreational sport fishery downstream of the Idaho/Washington border is divided into five sampling sections. WDFW estimates the monthly harvest in each section from the mouth of the Snake River to the Idaho/Washington border from September 1 to December 31, 2020 (Figure 2). Steelhead harvested in the Snake River upstream of the Idaho/Washington border (Section 650) were excluded from this report. The harvest estimates in these sections were based on catch record card data. The final monthly harvest estimates in each section are posted on the WDFW website (available at: <http://wdfw.wa.gov/fishing/harvest/>) when finalized.

### **Sample Collection in the Lower Columbia River Sport Fishery**

Sport anglers were sampled by the WDFW creel survey crews that were used to estimate harvest from Buoy 10 upstream to BON. All steelhead that were encountered had a small piece of tissue removed for the genetic analysis. In addition to a tissue sample, crews also checked the fish for a Coded Wire Tag, PIT tag, measured the fork length, and recorded the river section and date the fish was caught. Retention of steelhead was not permitted from August 1 to October 31, 2020. A total of 153 samples were genotyped for analysis of the sport fishery. We estimated the stock composition and harvest contribution from June 16 to July 31, 2020 from these samples.

### **Sample collection from the Columbia River Cathlamet Channel Pound Net**

The Pound Net is located in the Columbia River Cathlamet Channel at river kilometer 67 and was fished from late August to early October in 2020. At the request of IDFG, steelhead that were trapped had a small fin clip removed and sent to the IDFG genetics lab for analysis. In addition to a tissue sample, crews recorded the date of capture, the presence or absence of the adipose fin, and the fork length of each fish. All steelhead that entered the Pound Net were released after sampling. A total of 540 samples (362 clipped and 178 unclipped) were successfully genotyped and used to estimate the stock composition. The first sample was obtained on August 28 and the last fish was sampled on October 9, 2020.

### **Sample Collection in the Lower Snake River Fishery**

WDFW crews sampled anglers in the Snake River downstream of the Idaho/Washington border. Crews measured the fork length and recorded the location and date the fish was caught. A total of 95 samples were genotyped for analysis of the sport fishery. We estimated the stock composition from September 1 to December 31, 2020 from these samples.

### **Estimating Composition Proportions**

Clipped steelhead are known to be hatchery origin whereas unclipped steelhead could be an unclipped hatchery fish or wild fish. All fish were genotyped at 368 SNPs for an assignment to a GSI reporting group, a possible assignment to a hatchery release group and BY using PBT, and a sex-specific genetic assay for determining the sex of the fish. The genotyping was done at the IDFG genetics lab. The GSI methodology is detailed in Ackerman et al. (2016) along with the methods for extraction of genomic DNA from tissue samples, DNA amplification, and SNP genotyping. Steele et al. (2016) contains similar details for PBT analysis. If a fish was identified with PBT, we assigned the fish to its release group and BY. Unclipped steelhead that were not identified with PBT were either a hatchery-origin fish whose parents were not in the PBT baseline or a wild-origin fish. All PBT unassigned fish (clipped and unclipped) were assigned to their most probable GSI reporting group that was developed by CRITFC and is described in Hess et al. 2013 (Figure 3). All adipose-clipped fish assigned to a GSI group were hatchery origin. We identified 42 distinct hatchery release groups from four BYs and 10 distinct GSI reporting groups in the samples that were analyzed from the Lower Columbia sport fishery, Lower Snake sport fishery, and those collected from the Pound Net.

All Snake River basin hatchery release groups were classified by brood year, rearing hatchery, hatchery stock, and release site and the non-Snake River basin hatchery release groups were classified by brood year and stock. All PBT release groups and GSI reporting groups were assigned to a river basin. For the stock composition analysis, the Wallowa-WA stock included fish released in the Walla Walla River basin, the Snake River at Lyons Ferry Hatchery, and the Grande Ronde River at the Cottonwood Acclimation Pond. Due to rearing space limitations at Lyons Ferry Hatchery, parental matings of the Wallowa-WA stock cannot be tracked to release site, hence all Wallowa-WA smolt releases were assigned to the Wallowa-WA stock and the Snake basin. The Wallowa-OR stock were from broodstock collected at Wallowa Hatchery, reared at Irrigon Hatchery, and released in the Oregon portion of the Snake River basin. The MGILCS GSI group includes tributaries of the Columbia River from BON to the Snake River mouth, Snake River tributaries downstream of the Clearwater River, the Asotin, Grande Ronde, and Imnaha basins, tributaries of the Salmon River upstream to the Little Salmon River, and tributaries of the Clearwater River upstream to the confluence of the Lochsa and Selway rivers. Since this group spans more than one river basin it was defined as a distinct basin. The SKAMAN GSI group was defined as natural origin steelhead that can trace their ancestry to the Skamania Hatchery stock. This GSI group and Skamania PBT release groups are closely related to each other and are found in the Willamette drainage and Columbia River tributaries upstream and downstream of BON. We treated these groups as a distinct basin since they are found in more than one river basin.

We analyzed the clipped and unclipped Pound Net samples together and reported the proportion of all sampled fish from each clipped and unclipped group. In sport fisheries, only adipose clipped fish can be retained. The actual count in each PBT release group was divided by its tagging rate to get an expanded count. The expanded count can be thought of as the expected number of fish from each release group that would have been sampled if the release group had a tag rate of 1. Since fish were added to hatchery release groups after expanding for their tag

rate, an equal number of fish must be subtracted from the fish that were assigned to GSI reporting groups. The composition proportions were calculated using the “accounting” estimator described by Delomas and Hess (2021) to incorporate the tag rates for each PBT release group using the R script *Scobi\_duex* performed in the R programming environment (R Development Core Team 2009).

The proportion of each hatchery stock’s composition by brood year was found by adding all of the stock’s release group BYs proportions. The proportion of each hatchery stock was found by summing all of the stock’s release groups and BYs. We also present results at the river basin spatial scale for stock composition proportions. Basin level proportions were found by summing all PBT and GSI group proportions within each river basin. All proportions were reported as percentages rounded to the nearest tenth percent except the basin level percentages which were rounded to the nearest percent. Harvest estimates in the Lower Columbia River sport fishery were calculated by multiplying the composition proportions by the reported harvest estimate and rounding to the nearest fish.

### **Confidence Intervals for Group, Stock, and Basin Proportions**

Confidence intervals (CIs) for the PBT release groups and GSI reporting groups estimates were generated using *Scobi\_duex*. The script resamples with replacement from an original sample or set of data. For each iteration, the original group assignments were resampled with replacement  $s$  number of times where  $s$  = the number of samples. Within each iteration, we then calculated the expanded PBT hatchery release group and adjusted GSI reporting group proportions as outlined in the previous section. We performed 10,000 iterations and sorted the proportions in ascending order. The  $100(1-\alpha)\%$  CIs for the group proportions were the  $(10,000 * \alpha/2)$  and  $(10,000 * (1 - \alpha/2))$  values of the ordered bootstrap values. In the analysis we set  $\alpha = 0.05$  and report the 90% lower CI (lci) and 90% upper CI (uci) for all proportions. The CIs for each PBT stock/BY and PBT stock, was found by summing all of the stock’s release groups of each BY and all of the stock’s release groups in each iteration and choosing the  $(10,000 * \alpha/2)$  and  $(10,000 * (1 - \alpha/2))$  ordered values. The CIs at the basin spatial scale was found by summing all PBT and GSI groups by their basin assignment in each iteration and choosing the  $(10,000 * \alpha/2)$  and  $(10,000 * (1 - \alpha/2))$  ordered values. All proportion CIs were reported as percentages rounded to the nearest tenth percent. The R package containing *Scobi\_duex* can be found at <https://github.com/delomast/fishCompTools>.

### **Ocean Age and Length Percentages**

The percent of 1-ocean fish was calculated for each hatchery stock identified with PBT using the expanded count of 1-ocean fish (BY2018) and the sum of expanded counts of all ocean ages that returned in 2020. Ocean ages were not available for fish that assigned to GSI groups since scale samples were not taken from the sampled fish.

We estimated the number of large ( $\geq 78$  cm or B-Index) and small ( $< 78$  cm or A-Index) steelhead in each hatchery and GSI stock from each fishery by performing a maximum likelihood estimation of the length composition to estimate the proportions of large and small fish in each stock while accounting for tag rates. The sum of small and large fish for the length analysis may not equal the expanded count for PBT assigned fish or the adjusted count of the GSI assigned fish used to calculate the stock composition proportions for two reasons: 1) the stock composition proportions were calculated using all genotyped samples whereas the length composition

proportions were calculated using only samples with length data and 2) the estimators, while similar in logic, are different, and so the estimates will not be identical. The ML method used for length analysis was executed using the R package *fishCompTools* (<https://github.com/delomast/fishCompTools>).

The counts of fish that were PBT assigned (PBT-tagged) to a given hatchery group,  $n_1, \dots, n_G$ , with tag rates of  $t_1, t_2, \dots, t_G$  or were PBT unassigned,  $u$  was considered to be a multinomial random variable,

$$\begin{aligned} (n_1, \dots, n_G, u) &\sim \text{mult}(N, \pi), \\ \pi &= (p_1 t_1, p_2 t_2, \dots, p_G t_G, y), \\ y &= w + \sum_{i=1}^G p_i (1 - t_i), \end{aligned}$$

where  $p_i$  is the probability that a fish is from hatchery group  $i$  (i.e assigned with PBT),  $w$  is the probability a fish is from a PBT-untagged GSI group (e.g. a wild fish or a hatchery fish that was from an unsampled stock) and  $y$  is the probability that a fish is PBT-untagged. The probability that a fish is PBT-untagged is the sum (because the events are disjoint) of the probabilities that a fish is from a GSI stock (i.e. wild fish or an unsampled hatchery stock) or from a PBT-tagged group that had a tag rate  $< 1$ .

Let the PBT-untagged group be composed of  $S$  different genetic stocks, and let  $u$  be a vector with  $u_j$  being the number of PBT-untagged fish that assign to GSI stock  $j$  for  $j$  in  $1, 2, \dots, S$ . The counts of PBT-tagged fish in each hatchery group and the counts of PBT-untagged fish assigned to each stock though GSI was again considered to be a multinomial random variable,

$$\begin{aligned} (n_1, \dots, n_G, u_1, \dots, u_S) &\sim \text{mult}(N, \pi), \\ \pi &= (p_1 t_1, p_2 t_2, \dots, p_G t_G, y_1, \dots, y_S), \\ y_j &= w_j + \sum_{i=1}^G p_i (1 - t_i) D_{ij}, \end{aligned}$$

where  $y_j$  is the probability a fish is PBT-untagged and assigns to stock GSI  $j$ ,  $w_j$  is the probability a fish is from a PBT-untagged group and in GSI stock  $j$ , and  $D_{ij}$  is the probability a fish in hatchery group  $i$  assigns to GSI stock  $j$ .

The assigned stocks of the PBT-tagged hatchery fish was also considered to be a multinomial random variable,

$$(O_{i1}, \dots, O_{iS}) \sim \text{mult}(n_i, (D_{i1}, \dots, D_{iS})), \quad (1)$$

where  $O_{ij}$  is the number of PBT-tagged fish in hatchery group  $i$  that assigned to GSI stock  $j$ .

Length was treated as a categorical variable, with fish less than 78 cm being “small” and fish greater than or equal to 78 cm being “large”. We used 78 cm since it is the basis of the A/B-Index summer steelhead length based management used in *U.S. v. Oregon* fisheries, however a user can input any length desired. We assume that within a given hatchery group the length is independent of the GSI assigned stock. This is likely to be the case unless a hatchery group being estimated is a combination of genetically distinct strains that are only being estimated as one group because tag rates are not available for them separately. Let  $u$  now be such that  $u_{jk}$  is the



number of PBT-untagged fish that assign to GSI stock  $j$  and are in length category  $k$  with  $k$  in  $\{1,2\}$ . The counts of PBT-tagged fish and PBT-untagged fish in each combination of stock and length category were considered to be a multinomial random variable,

$$\begin{aligned} (n_1, \dots, n_G, u_{11}, \dots, u_{S2}) &\sim \text{mult}(N, \pi), \\ \pi &= (p_1 t_1, p_2 t_2, \dots, p_G t_G, y_{11}, \dots, y_{S2}), \\ y_{jk} &= w_{jk} + \sum_{i=1}^G p_i (1 - t_i) D_{ij} V_{ik}, \end{aligned} \quad (2)$$

where  $y_{jk}$  is the probability a fish is PBT-untagged, assigns to GSI stock  $j$ , and is in length category  $k$ ;  $w_{jk}$  is the probability a fish is from a PBT-untagged group, in GSI stock  $j$ , and in length category  $k$ ; and  $V_{ik}$  is the probability a fish in hatchery group  $i$  is in length category  $k$ .

The number of PBT-tagged fish in a given hatchery group that are in a given length category was considered to be a multinomial random variable,

$$(Q_{i1}, \dots, Q_{iK}) \sim \text{mult}(n_i, (V_{i1}, \dots, V_{iK})), \quad (3)$$

where  $Q_{ik}$  is the number of PBT-tagged fish in hatchery group  $i$  that were in length category  $k$ . The likelihood of the data as a whole,  $P(n, u, O, Q | \pi, D, V)$  is the product of three multinomial likelihoods (equations 1, 2, and 3) that can be maximized to infer  $p$ ,  $w$ ,  $D$ , and  $V$ .

The estimates for  $p$ ,  $w$ , and  $V$  were multiplied as appropriate to estimate fishery composition by group and size. These estimates were then summed to calculate composition at different scales (stock, basin, and origin). Non-parametric bootstrapping with 10,000 iterations was utilized to calculate 90% lci and uci.

For each sport fishery and the Pound Net clipped and unclipped samples we report the percentage of the sampled fish and the 90% binomial CI that were large using the actual count of all samples with a valid length measurement. Next we focus on large fish only, as *U.S. V. Oregon* managed fisheries are often constrained by the abundance of large steelhead. We report the percentage of the large fish from each stock using the large ML proportion estimates and the percentage of large fish within each stock using the ML estimates of large and small proportions within the stock. Non-parametric bootstrapping with 10,000 iterations was utilized to calculate the 90% lci and uci.

## RESULTS

### Steelhead Passage at Bonneville Dam

Steelhead passage from July 1 to October 31 was 107,591 total fish of which 65,543 were clipped fish and 42,048 were unclipped fish. The clipped return was made up of 42,542 A-Index (Small) fish and 23,001 B-Index (Large) fish. The estimated wild passage was 28,071 A-Index fish and 5,169 B-Index fish. The estimated hatchery unclipped passage was 4,826 A-Index fish and 3,983 B-Index fish. The return of all A-Index components was less than the pre-season forecast except the unclipped hatchery fish. The return of each B-Index component was more than three times their pre-season forecast.

### **Steelhead Run-Timing at Bonneville Dam**

The Skamania stock released in the Klickitat River was the earliest arriving stock at BON. The 50% arrival date for Skamania stock was on July 10 and was reached nearly three weeks before the next hatchery stock reached its 50% date. The 90% arrival date for the Skamania hatchery stock was July 25 and was attained before all other hatchery stocks reached their 50% arrival date. The earliest Snake basin hatchery stock were the Imnaha and Tucannon which had a 50% passage date of July 30 and July 31, respectively. All other Snake River, Mid-C, and Upper-C basin hatchery stocks attained their 50% arrival date between August 2 and August 13 except for the Dworshak stock released in the Salmon drainage (Dwor-S) and Clearwater drainage (Dwor-C), the SF Clearwater, and Upper Salmon stocks. These later timed stocks attained their 50% date on: September 11 (Dwor-C), September 12 (Upper Salmon), September 14 (SF Clearwater), and September 22 (Dwor-S). The 50% arrival date for the Snake River hatchery stocks spanned 54 days and ranged from July 30 to September 22 (Figure 4 and Appendix A). Wild fish from the Up-C, Mid-C, and Snake attained their 50% date on July 23, July 24, and July 30, respectively.

The BON passage of Dwor-C, Dwor-S, SF Clearwater, and Upper Salmon hatchery stocks on August 1, 2020, the day the Lower Columbia sport fishery closed, ranged from 0% to 2% complete. The BON passage of all other Snake basin hatchery stocks ranged from 30% to 56% complete. The Mid-C and Up-C hatchery stocks were 39% and 46% complete on August 1. The Snake River wild stock passage on August 1 was 53% complete compared to 72% for the Up-C and 70% for the Mid-C wild stocks (Figure 4).

The BON passage of steelhead stocks during the time period samples were collected at the Pound Net (August 26 to October 9, 2020) fell into two distinct groups. The later timed Dwor-C, Dwor-S, SF Clearwater, and Upper Salmon hatchery stocks had 83% to 91% of their total passage at BON when steelhead were sampled at the Pound Net. All other hatchery stocks and all wild stocks during this time period had between 1% to 29% of their total passage at BON (Figure 4 and Appendix A).

### **Lower Columbia River Sport Harvest Estimate**

In the lower Columbia River sport anglers kept 1,996 steelhead from June 16 to July 31, 2020.

### **Lower Snake River Sport Harvest Estimate**

At the time this report was compiled the sport harvest estimate from the Lower Snake sport fishery was not available, hence we only report the percentage of samples from each release group, stock and BY, and stock.

### **Estimating Composition Proportions And Harvest Contribution**

#### **Lower Columbia River Sport**

We assigned fish to 22 distinct PBT release groups and five GSI reporting groups for the PBT unassigned fish (Table 1). We estimate that 62.3% of the fish were from the PBT assigned

stocks (CI, 53.9% - 71.2%). Snake River hatchery stocks made up 39.2% (CI, 32.2% - 46.4%) of the harvest. The Mid-C hatchery stocks made up 3.9% (CI, 1.3% - 6.6%) and the Up-C hatchery stocks made up 3.4% (CI, 1.3% - 6%). The Skamania PBT assigned stocks made up 15.8% (CI, 9.5% - 23.2%) of the harvest. The PBT assigned hatchery stocks that provided the most harvest were the Skamania (15.8%), Pahsimeroi (10.7%), Wallowa-OR (8%), and Wallowa-WA (6.7%). Nearly 38% of the harvest was PBT unassigned. The SKAMAN GSI group was the largest contributor to the harvest (23.1%; CI, 16.7% - 29.5%). The remaining PBT unassigned fish were assigned to four GSI stocks that contributed from 0.6% to 6.2% of the harvest (Tables 2 and 3, Figure 5). The Snake basin stock's made up 45% of the harvest and the SKAMAN basin made up 39% of the harvest. All other basins contributed 6% or less of the harvested fish (Figure 6). The stock percentages and harvest estimates for each PBT release group can be found in Appendix B.

One-ocean adults made up 7% (CI 3.1% - 13.3%) of the PBT assigned return. The percent 1-ocean, of stocks with a total adjusted count  $\geq 10$ , ranged from 18.7% in the Pahsimeroi stock to 0% in the Skamania stock (Table 3).

Eleven of the 153 sampled fish were large fish (7.2%; CI, 4.1% - 11.6%). The SKAMAN stock made up 35.8% (CI, 11.7% - 61.7%) of the large fish and 9.7% (CI, 0% - 26.6%) came from the Skamania PBT stock. Five other stocks, the Imnaha, Pahsimeroi, Wallowa-OR, Wallowa-WA, and LOWCOL had large fish. The percent of large fish within each stock with large fish present ranged from 32% in the Imnaha stock to 4.4% in the Skamania stock, however only three fish were assigned to the Imnaha stock (Table 4).

## **Pound Net**

### *Adipose clipped fish*

We assigned clipped fish to 36 distinct PBT release groups and 11 GSI reporting groups for the PBT unassigned fish (Table 5). The clipped hatchery fish made up (67% (CI, 63.7% - 70.4%) of all sampled fish (Figure 7). We estimate that 62.1% of all sampled fish were from the PBT assigned stocks (CI, 58.4% - 65.9%). Snake River clipped hatchery stocks made up 61% (CI, 57.3% - 64.7%) of the sampled fish. The Mid-C and Up-C clipped hatchery stocks made up less than 1% of the sampled fish. PBT unassigned hatchery origin clipped fish made up 4.9% (CI, 2.9% - 7.1%) of the sampled fish. The clipped Dwor-C stock made up 31.1% (CI, 27.6% - 34.6%) and clipped Pahsimeroi stock made up 10.1% (CI 8% - 12.3%) of the sampled fish. The other 12 clipped hatchery stocks each made up  $\leq 5\%$  of the sampled fish (Tables 6 and 7, Figure 8). The Snake basin stocks made up 95% of the clipped hatchery fish sampled (Figure 9). The stock percentages for each clipped PBT release group can be found in Appendix C.

One-ocean adults made up 16.3% (CI 13.2% - 19.8%) of all clipped fish sampled. The percent 1-ocean, of clipped stocks with a total adjusted count  $\geq 10$ , ranged from 85.7% in the Wallowa-WA stock to 2.6% in the Dwor-C stock (Table 7).

One hundred fifty nine of the 362 sampled clipped fish were large (43.9%; CI, 39.5% - 48.4%). The Dwor-C stock made up 72% (CI, 65.3% - 78.1%) of the large clipped fish and 22.6% (CI, 17.2% - 28.2%) came from the SF Clearwater stock. Large steelhead were also present in the Dwor-S, MGILCS, and SFCLWR stocks, however each made up less than 3% of the total large clipped fish. (Table 8).

### *Adipose unclipped fish*

Unclipped hatchery origin fish made up 14% (CI, 11.5% - 16.5) of all sampled fish (Figure 6). All of the unclipped hatchery origin fish were from the Snake basin. The SF Clearwater stock made up 7.04% (CI, 5.4% - 8.9%) of the sampled fish. All other unclipped hatchery stock's each made up less than 3.5% of the sampled fish (Table 9 and Figure 10). Forty two of the 178 (23.6%; CI 18.4% - 29.4%) unclipped fish sampled were large. Unclipped hatchery origin fish made up 53.3% (40.1% - 66%) of the large unclipped fish sampled. The SF Clearwater stock made up 35.7% (CI, 23.7% - 48.5%) of the unclipped large fish. Large fish were also present in the unclipped Dwor-C and Upper Salmon stocks (Table 10). The stock percentages for each unclipped hatchery PBT release group can be found in Appendix C.

Wild fish made up 19% (CI, 16.2% - 21.9%) of all sampled fish (Figure 6). We assigned wild fish to 10 GSI stocks, however none exceed 5.5% of the total fish sampled and three made up less than 1% each of the sampled fish (Table 9 and Figure 10). The Snake and MGILCS basins made up 67% and 22% of the wild fish sampled, respectively (Figure 11). Wild fish made up 46.7% (CI, 34% - 59.9%) of all large unclipped fish sampled. The SFCLWR and UPCLWR made up 13.4% (CI, 4.8% - 22.8%) and 14.3% (CI, 5.9% - 23.5%) of the large unclipped fish sampled. The other eight GSI stocks with large fish present each made up less than 5% of the total large fish sampled (Table 10).

### **Lower Snake River sport**

We assigned fish to 19 PBT release groups and two GSI stocks. All fish were adipose clipped hatchery origin (Table 11). All of the assigned fish were from the Snake River basin. We assigned 89.8% (CI, 83% - 96.1%) of the samples to PBT stocks and 10.2% (CI, 3.9% - 17%) of the samples were PBT unassigned. About 50% of the samples assigned to the Dwor-C and Wallowa-WA stocks. We made assignments to eight other stocks, however none made up more than 8% each of the total sampled fish (Tables 12 and 13, Figure 12). The stock percentages for each PBT release group can be found in Appendix D.

One ocean fish made up 9.9% (CI, 5% - 17.1%) of the PBT assigned return. Of the 95 fish sampled 26 were large (27.4%, CI, 19.9% - 35.9%). Most of the large fish were from the Dwor-C (67.2%; CI, 49.6% - 84.2%), SFCLWR GSI stock (13.5%; CI 0.5% - 28%), and SF Clearwater (11.5%; CI, 2.9% - 22.6%) stocks. Only two other stocks had large fish and each made up less than 4% of the total large fish (Table 14).

## **DISCUSSION**

This year we analyzed the data with the R script *Scobi\_duex* rather than *Bootstock*. *Scobi\_duex* was modified from the program IDFG has used to analyze the stock composition of Chinook and steelhead sampled at Lower Granite Dam since 2008. There are minor differences in the method to adjust the GSI stock counts after expanding for PBT tagrates, however a comparison of the two approaches found little difference in the final estimates. The main advantage of *Scobi\_duex* is that both clipped and unclipped samples can be analyzed at the same time whereas *Bootstock* was written to produce stock composition estimates for the clipped and unclipped samples separately. The ability of *Scobi\_duex* to handle both clipped and unclipped samples allowed us to make stock composition estimates of all sampled fish collected at the Pound Net. In previous reports we presented the Pound Net stock composition estimates for

clipped and unclipped fish separately. All of the sport fisheries we sampled allowed retention of adipose clipped fish only. This year we used Snake basin PBT release groups at the rearing hatchery/stock/BY/release site level and used tagrates calculated at that spatial scale. These groups were then summed to get stock/BY and stock estimates for the Snake basin hatchery stocks. Non-Snake PBT release groups and tagrates were defined at the stock/BY spatial scale. In all previous years analysis we defined all PBT release groups and used tagrates at the stock/BY spatial scale.

The majority of summer steelhead hatchery smolts released in the Columbia River basin are reared in Snake River basin hatcheries. Most of the returning hatchery origin steelhead are typically 1-ocean or 2-ocean fish. Clipped steelhead that were assigned to a GSI group are known to be hatchery origin (because of the clipped adipose fin), whereas unclipped GSI assigned fish are considered to be putative wild fish if they did not assign to a PBT release group. The GSI groups within the Snake River basin were developed using only wild origin fish, however the non-Snake GSI groups were developed using both hatchery and wild origin fish. Nearly all broodstock from hatcheries upstream of BON are genotyped and in the PBT database and have high tagrates, therefore any unclipped fish that were assigned to GSI reporting groups located upstream of BON were likely wild origin. We do not have broodstock from most hatchery programs downstream of BON genotyped and in the PBT database, hence many hatchery origin adults sampled in the lower Columbia River cannot be assigned to a PBT release group. Unclipped steelhead that assigned to GSI reporting groups located downstream of BON could be a wild or an unclipped hatchery origin fish.

The SKAMAN GSI group is very closely related to the Skamania Hatchery stock summer steelhead. Over 99% of known Skamania Hatchery summer steelhead would assign to the SKAMAN GSI reporting group if their PBT assignment was not used. Most of the summer steelhead hatchery programs in the Lower Columbia (Cowlitz and Lewis) and those in the Willamette River basin derived their broodstock from the Skamania summer run stock and their broodstock is not genotyped. We expect that adults sampled from these hatchery programs that are not in the PBT baseline would assign to the SKAMAN GSI reporting group.

The July 1 to October 31, 2020 total steelhead count at BON was the third lowest since 2000, however it was an increase from the prior two years. Sport fisheries were constrained by time and area closures in 2020. The lower Columbia River sport harvest from June 16 to July 31 was 1,996 and was the second lowest harvest in that time period since 2000. The only year with less fish harvested from June 16 to July 31 was 2017 (harvest of 1,439). Steelhead retention was not permitted in the Lower Columbia River from August 1 to October 31 in 2020. It follows that if few fish get caught, few get sampled. Our sample size of 153 was less than the 216 samples we collected in the same time frame in 2017. The lower Snake sport fishery estimates were based on a sample size of 95. Due to the low sample size the estimated stock and harvest composition estimates in these fisheries should be viewed cautiously. The reported CIs reflect the lack of precision in most estimates because of the low sample size we had to make the estimates.

The Snake basin made up 45% of the harvest in the lower Columbia River sport fishery and was composed of the early arriving stocks. Less than 1% of the harvest came from the four later arriving Snake hatchery stocks—Dwor-C, Dwor-S, SF Clearwater, and Upper Salmon. The percentage of passage at BON on August 1 when this fishery closed, was less than 2% for each of these later timed stocks. In this fishery we have seen a consistent increase in the stock contribution from the Snake basin as the season progresses in all years since 2011. Had the river been open to harvest after July 31, most of the harvest would have been from Snake basin hatchery stocks based on prior years analysis of the monthly stock composition of the catch. The

early closure of this fishery weighted the catch to the earlier arriving stocks, primarily the Skamania PBT and SKAMAN GSI stocks, and caused the Snake basin contribution to be lower than usual. All large fish were from three basins—Low-C (9%), SKAMAN (45.5%), and Snake (45.5%). Typically the number of large fish from the Snake basin caught in this fishery increases in August as the Dwor-C stock arrives, however this year the season was closed on August 1 and no Dwor-C large fish were sampled.

The Pound Net sampled steelhead from August 28 to October 9. The percentage of the total passage of the four late Snake basin stocks (Dwor-C, Dwor-S, SF Clearwater, and Upper Salmon) at BON during this time period ranged from 83% to 91% (Appendix A). All other hatchery stocks had less than 30% of their total passage at BON during this time period. The Snake basin wild stock had 24% of its total passage at BON during this time period whereas the Up-C and Mid-C wild stocks had less than 6% of theirs. The dominance of Snake basin stocks sampled at the Pound Net was a reflection of the run-timing as measured at BON. Over 31% of the fish sampled at the Pound Net were clipped Dwor-C stock and it was most abundant hatchery or wild stock sampled. An additional 12% of the total fish sampled were assigned to the late arriving clipped Dwor-S, SF Clearwater, and Upper Salmon stocks. All of the remaining earlier arriving stocks each made up  $\leq 5\%$  of the fish sampled. Less than 2% of the fish were assigned to Mid-C and Up-C hatchery stocks.

About 33% of the sampled Pound Net fish were unclipped and 42% of the unclipped fish were assigned to hatchery stocks. All of the unclipped hatchery origin fish were from the Snake basin and most of these were from the Dwor-C, SF Clearwater, and Upper Salmon stocks. Sixty seven percent of the wild fish were from the Snake basin and 22% were from the MIGILCS basin. Since the MIGILCS basin contains rivers within the Snake basin, the actual contribution of wild fish from the Snake basin was likely greater than 67%.

Most of the large or B-Index steelhead captured in the Pound Net were Snake basin stocks. Nearly 99% of the clipped large fish and 91% of the unclipped large fish were from the Snake basin. About 44% of all clipped fish were large and came from five stocks, however most were from the Dwor-C (72%) and SF Clearwater (22.6%) stocks. The unclipped hatchery origin stocks made up 53% of all unclipped large fish and came from three stocks: SF Clearwater (35.7%), Upper Salmon (9.5%), and Dwor-C (8%). Wild fish made up 47% of all unclipped large fish and were assigned to seven GSI stocks. The UPCLWR (14.3%) and SFCLWR (13.4%) contributed the most large wild fish and the other 5 GSI stocks each contributed less 5% each. This result is consistent with previous years analysis of Pound Net and sport fisheries in the lower Columbia River from August to October—most of the large fish came from the Snake basin. Most large hatchery fish were Dwor-C and most large wild fish were from the UPCLWR, SFCLWR, and SFSALM GSI stocks. The stocks that contribute most of the large steelhead have a run-timing that is similar to fall Chinook, hence steelhead encountered in sport or commercial fisheries from late August through October will more likely be from these later timed stocks and more of the steelhead will likely be large compared to fisheries prosecuted in July and early August.

## REFERENCES

- Ackerman, M. W., N. Vu, and M. R. Campbell. 2016. Chinook and steelhead genotyping for genetic stock identification at Lower Granite Dam, 2015 annual report. BPA project 2010-026-00. Idaho Department of Fish and Game report 16-03. Boise
- Byrne, A, J. Hymer, S. Ellis, R. Dick II, K. Keller, C.A. Steele , J.E. Hess, M.W. Ackerman. 2014a. A genetic analysis of the summer steelhead stock composition in the 2011 Columbia River tribal and sport fisheries. Idaho Department of Fish and Game Report 14-11. Boise.
- Byrne, A, J. Hymer, S. Ellis, R. Dick II, K. Keller, C.A. Steele , J.E. Hess, M. Begay, J.D. Bumgarner. 2014b. A genetic analysis of the summer steelhead stock composition in the Columbia River and Snake River tribal and sport fisheries from July 1, 2012 to March 31, 2013. Idaho Department of Fish and Game Report 14-12. Boise.
- Byrne, A, J. Hymer, S. Ellis, R. Dick II, K. Keller, C.A. Steele , J.E. Hess, M. Begay, T. Miller. 2015. A genetic analysis of the summer steelhead stock composition in the Columbia River and Snake River tribal and sport fisheries from July 1, 2013 to March 31, 2014. Idaho Department of Fish and Game Report 15-06. Boise.
- Byrne, A, J. Hymer, S. Ellis, R. Dick II, K. Keller, C.A. Steele , J.E. Hess, M. Begay, T. Miller. 2016. A genetic analysis of the summer steelhead stock composition in the Columbia River and Snake River tribal and sport fisheries from June 16, 2014 to March 31, 2015. Idaho Department of Fish and Game Report 16-104. Boise.
- Byrne, A, J. Hymer, S. Ellis, R. Dick II, K. Keller, C.A. Steele , M. Begay, T. Miller. 2018a. A genetic analysis of the summer steelhead stock composition in the Columbia River and Snake River tribal and sport fisheries from June 16, 2015 to March 31, 2016. Idaho Department of Fish and Game 18-106.
- Byrne, A, J. Hymer, S. Ellis, R. Dick II, K. Keller, C.A. Steele , M. Begay, T. Miller. 2018b. A genetic analysis of the summer steelhead stock composition in the Columbia River and Snake River tribal and sport fisheries from June 16, 2016 to March 31, 2017. Idaho Department of Fish and Game 18-107. Boise.
- Byrne, A, J. Hymer, S. Ellis, R. Dick II, K. Keller, C.A. Steele , M. Begay, T. Miller. 2018c. A genetic analysis of the summer steelhead stock composition in the Columbia River and Snake River tribal and sport fisheries from June 16, 2017 to December 31, 2017. Idaho Department of Fish and Game 18-108. Boise.
- Byrne, Alan. 2019. Summer steelhead stock composition of fish captured in the Columbia River Pound Net gear study in the fall of 2017 and 2018. Idaho Department of Fish and Game 19-111. Boise.
- Byrne, A, T. Delomas, K. Keller, M. Begay, S. Ellis, R. Dick II. 2020. A genetic analysis of the summer steelhead stock composition in the Columbia River tribal and sport fisheries. June 16, 2018 to November 30, 2018 and June 16, 2019 to November 30, 2019. Idaho Department of Fish and Game 20-112. Boise.
- Byrne, A and T. Delomas. 2020. Stock composition of summer steelhead captured in the Columbia River Cathlamet Channel Pound Net in 2019. Idaho Department of Fish and Game 20-113. Boise.
- Campbell, M.R., C.C. Kozfkay, T. Copeland, W.C. Schrader, M.W. Ackerman, and S.R. Narum. 2012. Estimating Abundance and Life History Characteristics of Threatened Wild Snake

- River Steelhead Stocks by Using Genetic Stock Identification. Transactions of the American Fisheries Society 141(5):1310–1327.
- Delomas, T. A., & Hess, J. E. (2021). A new estimator to correct for bias from tag rate expansion on natural-origin fish attributes in mixed-stock analysis using parentage-based tagging. North American Journal of Fisheries Management, 41(2), 421-433.
- Hess, J.E., N.R. Campbell, A.P. Matala, and S.R. Narum. 2013. 2012 Annual Report: Genetic Assessment of Columbia River Stocks. U.S. Department of Energy Bonneville Power Administration Report Project #2008-907-00.
- R Development Core Team. 2009. The comprehensive R archive network. Available: <http://cran.r-project.org/> (February 2013).
- Steele, C., J. McCane, M. Ackerman, N. Vu, M. Campbell. 2016. Parentage Based Tagging of Snake River Hatchery Steelhead and Chinook salmon. Idaho Department of Fish and Game. Report 16-02. Boise
- TAC 2008. *U.S. v Oregon* Technical Advisory Committee. Biological Assessment of Incidental Impacts on Salmon Species Listed Under the Endangered Species Act in the 2008-2017 Non-Indian and Treaty Indian Fisheries in the Columbia River Basin. April 21, 2008.
- Watts, James W. February 2020 (in draft). The 2018 Lower Columbia River and Buoy 10 Recreational Fisheries. Oregon Department of Fish and Wildlife. Columbia River Management. Clackamas.



Table 1. All distinct PBT release groups with their stock assignment, basin assignment, brood year (BY), and tagrate that were sampled in the Lower Columbia River sport fishery from June 16 to July 31, 2020. The GSI stock assignment was used for fish that were not assigned to a PBT release group.

<b>PBT release group</b>	<b>Stock</b>	<b>Basin</b>	<b>BY</b>	<b>Tagrate</b>
2016-Skamania	Skamania	SKAMAN	2016	0.2011
2017-Deschutes	Deschutes	Mid-C	2017	0.998
2017-DWOR-DWOR-ClearCr-AdClip	Dwor-C	Snake	2017	0.9792
2017-HNFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2017	0.9926
2017-IRRI-IMNA-Imnaha	Imnaha	Snake	2017	0.9394
2017-IRRI-WALL-GrandeRondeR/WallowaR	Wallowa-OR	Snake	2017	0.9831
2017-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2017	0.9836
2017-Methow	Methow	Up-C	2017	1
2017-MVFH-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2017	0.9884
2017-MVFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2017	1
2017-NIAG-OXBO-LittleSalmonR-AdClip	Oxbow	Snake	2017	0.4808
2017-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2017	0.5472
2017-NIAG-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2017	1
2017-NIAG-PAHS-PahsimeroiR-AdClip	Pahsimeroi	Snake	2017	0.9697
2017-Okanogan	Okanogan	Up-C	2017	1
2017-Skamania	Skamania	SKAMAN	2017	0.9403
2017-Umatilla	Umatilla	Mid-C	2017	0.9728
2017-Wells	Wells	Up-C	2017	0.9551
2018-IRRI-WALL-WallowaR	Wallowa-OR	Snake	2018	0.9597
2018-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2018	0.9098
2018-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2018	0.9344
2018-NIAG-PAHS-PahsimeroiR-AdClip	Pahsimeroi	Snake	2018	0.9789
Unassigned	SKAMAN	SKAMAN	na	na
Unassigned	MGILCS	MGILCS	na	na
Unassigned	UPSALM	Snake	na	na
Unassigned	LOWCOL	Low-C	na	na
Unassigned	WILLAM	Low-C	na	na

Table 2. Stock composition and harvest estimates by stock and brood year (BY) in the Lower Columbia sport fishery, June 16 to July 31, 2020. All fish were adipose clipped. The GSI assignment was used for fish that did not assigned to a PBT release group.

Stock	BY	Sample size		Percent by group			Harvest by group		
		Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
<b><i>All PBT assigned</i></b>		<b>86</b>	<b>95.3</b>	<b>62.3%</b>	<b>53.9%</b>	<b>71.2%</b>	<b>1,243</b>	<b>1,076</b>	<b>1,420</b>
Skamania	2016	1	4.97	3.3%	0.0%	9.8%	65	0	195
Skamania	2017	18	19.14	12.5%	8.3%	17.4%	250	166	347
<b><i>Mid-C basin PBT assigned</i></b>		<b>6</b>	<b>6.04</b>	<b>3.9%</b>	<b>1.3%</b>	<b>6.6%</b>	<b>79</b>	<b>26</b>	<b>131</b>
Deschutes	2017	5	5.01	3.3%	1.3%	5.9%	65	26	118
Umatilla	2017	1	1.03	0.7%	0.0%	2.0%	13	0	40
<b><i>Snake basin PBT assigned</i></b>		<b>56</b>	<b>59.98</b>	<b>39.2%</b>	<b>32.2%</b>	<b>46.4%</b>	<b>782</b>	<b>643</b>	<b>926</b>
Dwor-C	2017	1	1.02	0.7%	0.0%	2.0%	13	0	40
Imnaha	2017	3	3.19	2.1%	0.7%	4.2%	42	14	83
Oxbow	2017	3	5.73	3.7%	1.2%	7.5%	75	24	150
Oxbow	2018	1	1.07	0.7%	0.0%	2.1%	14	0	42
Pahsimeroi	2017	13	13.36	8.7%	5.4%	12.8%	174	107	255
Pahsimeroi	2018	3	3.06	2.0%	0.7%	4.0%	40	13	80
Sawtooth	2017	10	10.06	6.6%	3.3%	9.9%	131	66	197
Wallowa-OR	2017	11	11.19	7.3%	4.0%	10.6%	146	80	212
Wallowa-OR	2018	1	1.04	0.7%	0.0%	2.0%	14	0	41
Wallowa-WA	2017	9	9.15	6.0%	3.3%	9.3%	119	66	186
Wallowa-WA	2018	1	1.10	0.7%	0.0%	2.2%	14	0	43
<b><i>Up-C basin PBT assigned</i></b>		<b>5</b>	<b>5.14</b>	<b>3.4%</b>	<b>1.3%</b>	<b>6.0%</b>	<b>67</b>	<b>26</b>	<b>120</b>
Methow	2017	1	1.00	0.7%	0.0%	2.0%	13	0	39
Okanogan	2017	1	1.00	0.7%	0.0%	2.0%	13	0	39
Wells	2017	3	3.14	2.1%	0.7%	4.1%	41	14	82

Table 2 (continued)

Stock	BY	Sample size		Percent by group			Harvest by group		
		Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
<u><b>Hatchery origin GSI assigned</b></u>									
<b>All GSI assigned</b>		<b>67</b>	<b>57.7</b>	<b>37.7%</b>	<b>28.8%</b>	<b>46.1%</b>	<b>753</b>	<b>576</b>	<b>920</b>
LOWCOL		4	3.4	2.3%	0.6%	4.3%	45	11	85
MGILCS		10	8.6	5.6%	2.8%	8.8%	112	56	176
SKAMAN		41	35.3	23.1%	16.7%	29.5%	461	333	589
UPSALM		11	9.5	6.2%	3.3%	9.5%	124	65	190
WILLAM		1	0.9	0.6%	0.0%	1.7%	11	0	34

Table 3. Stock composition and harvest estimates by stock in the Lower Columbia sport fishery, June 16 to July 31, 2020. All fish were adipose clipped. The GSI assignment was used for fish that did not assigned to a PBT release group. Stock estimates may not equal the sum of their BY components due to rounding error.

Stock	Sample size		Percent by stock			Harvest by stock			Percent 1-ocean
	Actual	Adjusted	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci	
Skamania	19	24.12	15.8%	9.5%	23.2%	315	190	463	0%
<b><u>Mid-C basin</u></b>	<b>6</b>	<b>6.04</b>	<b>3.9%</b>	<b>1.3%</b>	<b>6.6%</b>	<b>79</b>	<b>26</b>	<b>131</b>	<b>0%</b>
Deschutes	5	5.01	3.3%	1.3%	5.9%	65	26	118	0%
Umatilla	1	1.03	0.7%	0.0%	2.0%	13	0	40	0%
<b><u>Snake basin</u></b>	<b>56</b>	<b>59.98</b>	<b>39.2%</b>	<b>32.2%</b>	<b>46.4%</b>	<b>782</b>	<b>643</b>	<b>926</b>	<b>10.5%</b>
Dwor-C	1	1.02	0.7%	0.0%	2.0%	13	0	40	0%
Imnaha	3	3.19	2.1%	0.7%	4.2%	42	14	83	0%
Oxbow	4	6.81	4.4%	1.2%	8.4%	89	24	167	15.7%
Pahsimeroi	16	16.42	10.7%	6.7%	14.9%	214	134	296	18.7%
Sawtooth	10	10.06	6.6%	3.3%	9.9%	131	66	197	0%
Wallowa-OR	12	12.23	8.0%	4.7%	12.0%	160	93	239	8.5%
Wallowa-WA	10	10.25	6.7%	3.4%	10.1%	134	67	202	10.7%
<b><u>Up-C basin</u></b>	<b>5</b>	<b>5.14</b>	<b>3.4%</b>	<b>1.3%</b>	<b>6.0%</b>	<b>67</b>	<b>26</b>	<b>120</b>	<b>0%</b>
Methow	1	1.00	0.7%	0.0%	2.0%	13	0	39	0%
Okanogan	1	1.00	0.7%	0.0%	2.0%	13	0	39	0%
Wells	3	3.14	2.1%	0.7%	4.1%	41	14	82	0%
<b>PBT Unassigned</b>	<b>67</b>	<b>57.73</b>	<b>37.7%</b>	<b>28.8%</b>	<b>46.1%</b>	<b>753</b>	<b>576</b>	<b>920</b>	na

Table 4. The number of all fish and large fish sampled by stock and the maximum likelihood (ML) estimate of the percentage of the large fish from each stock and the percentage of fish within each stock that were large that were sampled in the Lower Columbia River sport fishery from June 16 to July 31, 2020.

Stock	Actual number sampled	Actual number of large fish	ML percent of total large	ML total 90% lci	ML total 90% uci	ML percent large within stock	ML within 90% lci	ML within 90% uci
<b>All samples</b>	<b>153</b>	<b>11</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>
Skamania	19	1	9.7%	0.0%	26.6%	4.4%	0.0%	13.3%
Deschutes	5	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Umatilla	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dwor-C	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Imnaha	3	1	9.1%	0.0%	25.0%	32.0%	0.0%	100.0%
Oxbow	4	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pahsimeroi	16	2	18.2%	0.0%	40.0%	12.2%	0.0%	28.0%
Sawtooth	10	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wallowa-OR	12	1	9.1%	0.0%	25.0%	8.2%	0.0%	24.5%
Wallowa-WA	10	1	9.1%	0.0%	25.0%	9.8%	0.0%	28.2%
Methow	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Okanogan	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wells	3	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b><u>Hatchery clipped assigned with GSI</u></b>								
LOWCOL	4	1	9.1%	0.0%	25.0%	25.0%	0.0%	66.7%
MGILCS	10	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SKAMAN	41	4	35.8%	11.7%	61.7%	11.0%	2.8%	21.5%
UPSALM	11	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
WILLAM	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5. All distinct PBT release groups with their stock assignment, basin assignment, brood year (BY), and tagrate that were sampled in the Pound Net from August 26 to October 9, 2020. The GSI stock assignment was used for fish that were not assigned to a PBT release group.

<b>PBT release group</b>	<b>Stock</b>	<b>Basin</b>	<b>BY</b>	<b>Tagrate</b>
2017-CLWH-SFCR-MeadowCr-AdClip	SF Clearwater	Snake	2017	1
2017-CLWH-SFCR-MeadowCr-NoClip	SF Clearwater	Snake	2017	1
2017-CLWH-SFCR-NewsomeCr-NoClip	SF Clearwater	Snake	2017	1
2017-CLWH-SFCR-RedHouse-AdClip	SF Clearwater	Snake	2017	1
2017-Deschutes	Deschutes	Mid-C	2017	0.998
2017-DWOR-DWOR-ClearCr-AdClip	Dwor-C	Snake	2017	0.9792
2017-DWOR-DWOR-LoloCr-NoClip	Dwor-C	Snake	2017	1
2017-DWOR-DWOR-NFClearwaterR-AdClip	Dwor-C	Snake	2017	0.8909
2017-DWOR-DWOR-RedHouse-AdClip	Dwor-C	Snake	2017	0.9625
2017-HNFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2017	0.9926
2017-IRRI-IMNA-Imnaha	Imnaha	Snake	2017	0.9394
2017-IRRI-WALL-GrandeRondeR/WallowaR	Wallowa-OR	Snake	2017	0.9831
2017-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2017	0.9836
2017-MVFH-DWOR-YankeeForkR-AdClip	Dwor-S	Snake	2017	0.9863
2017-MVFH-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2017	0.9884
2017-MVFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2017	1
2017-MVFH-USAL-PahsimeroiR-NoClip	Upper Salmon	Snake	2017	1
2017-MVFH-USAL-YankeeForkSalmonR-NoClip	Upper Salmon	Snake	2017	1
2017-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2017	0.5472
2017-NIAG-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2017	1
2017-NIAG-PAHS-PahsimeroiR-AdClip	Pahsimeroi	Snake	2017	0.9697
2017-Wells	Wells	Up-C	2017	0.9551
2018-CLWH-SFCR-MeadowCr-AdClip	SF Clearwater	Snake	2018	0.9333
2018-CLWH-SFCR-NewsomeCr-NoClip	SF Clearwater	Snake	2018	1
2018-CLWH-SFCR-RedHouse-AdClip	SF Clearwater	Snake	2018	0.925

Table 5 (continued)

<b>PBT release group</b>	<b>Stock</b>	<b>Basin</b>	<b>BY</b>	<b>Tagrate</b>
2018-DWOR-DWOR-NFClearwaterR-AdClip	Dwor-C	Snake	2018	0.8565
2018-HNFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2018	0.9086
2018-IRRI-IMNA-Imnaha	Imnaha	Snake	2018	0.7883
2018-IRRI-WALL-WallowaR	Wallowa-OR	Snake	2018	0.9597
2018-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2018	0.9098
2018-LYON-TUCA-TucannonR-WA	Tucannon	Snake	2018	0.8929
2018-Methow	Methow	Up-C	2018	0.966
2018-MVFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2018	0.9194
2018-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2018	0.9344
2018-NIAG-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2018	0.9
2018-NIAG-PAHS-PahsimeroiR-AdClip	Pahsimeroi	Snake	2018	0.9789
Unassigned	KLICKR	Mid-C	na	na
Unassigned	LOWCOL	Low-C	na	na
Unassigned	MFSALM	Snake	na	na
Unassigned	MGILCS	MGILCS	na	na
Unassigned	SFCLWR	Snake	na	na
Unassigned	SFSALM	Snake	na	na
Unassigned	SKAMAN	SKAMAN	na	na
Unassigned	UPCLWR	Snake	na	na
Unassigned	UPSALM	Snake	na	na
Unassigned	WILLAM	Low-C	na	na
Unassigned	YAKIMA	Mid-C	na	na

Table 6. The percentage of clipped hatchery origin fish by stock and brood year (BY) using all clipped and unclipped sampled fish (Percent by stock/BY --all) and the group's percentage of the hatchery clipped fish (Percent of H) sampled in the Pound Net, August 26 to October 9, 2020.

Stock	BY	Sample size		Percent by stock and BY--all			Percent of
		Actual	Adjust	Estimate	90% lci	90% uci	H only
<i>All PBT assigned</i>		316	335.4	62.1%	58.4%	65.9%	92.7%
<i>Mid-C basin PBT assigned</i>		3	3.01	0.6%	0.2%	1.1%	0.8%
Deschutes	2017	3	3.01	0.6%	0.2%	1.1%	0.8%
<i>Snake basin PBT assigned</i>		310	329.27	61.0%	57.3%	64.7%	91.0%
Dwor-C	2017	151	163.00	30.2%	26.8%	33.7%	45.0%
Dwor-C	2018	4	4.67	0.9%	0.2%	1.7%	1.3%
Dwor-S	2017	8	8.11	1.5%	0.8%	2.4%	2.2%
Imnaha	2017	3	3.19	0.6%	0.2%	1.2%	0.9%
Imnaha	2018	2	2.54	0.5%	0.0%	1.2%	0.7%
Oxbow	2017	2	3.65	0.7%	0.0%	1.4%	1.0%
Oxbow	2018	9	9.63	1.8%	0.8%	2.8%	2.7%
Pahsimeroi	2017	10	10.22	1.9%	0.9%	2.8%	2.8%
Pahsimeroi	2018	12	12.35	2.3%	1.3%	3.4%	3.4%
Sawtooth	2017	19	19.10	3.5%	2.2%	4.8%	5.3%
Sawtooth	2018	7	7.69	1.4%	0.6%	2.4%	2.1%
SF Clearwater	2017	50	50.00	9.3%	7.2%	11.3%	13.8%
SF Clearwater	2018	4	4.30	0.8%	0.2%	1.6%	1.2%
Tucannon	2018	2	2.24	0.4%	0.0%	1.0%	0.6%
Upper Salmon	2017	1	1.00	0.2%	0.0%	0.6%	0.3%
Wallowa-OR	2017	6	6.10	1.1%	0.4%	1.9%	1.7%
Wallowa-OR	2018	6	6.25	1.2%	0.4%	1.9%	1.7%
Wallowa-WA	2017	2	2.03	0.4%	0.0%	0.9%	0.6%
Wallowa-WA	2018	12	13.19	2.4%	1.4%	3.7%	3.6%



Table 6 (continued)

Stock	BY	Sample size		Percent by stock and BY--all			Percent of
		Actual	Adjust	Estimate	90% lci	90% uci	H only
<b><u>Up-C basin PBT assigned</u></b>		<b>3</b>	<b>3.13</b>	<b>0.6%</b>	<b>0.2%</b>	<b>1.2%</b>	<b>0.9%</b>
Methow	2018	1	1.04	0.2%	0.0%	0.6%	0.3%
Wells	2017	2	2.09	0.4%	0.0%	1.0%	0.6%
<b><u>Hatchery origin GSI assigned</u></b>							
<b><u>All GSI assigned</u></b>		<b>46</b>	<b>26.6</b>	<b>4.9%</b>	<b>2.9%</b>	<b>7.1%</b>	<b>7.3%</b>
MGILCS		5	2.9	0.5%	0.2%	1.0%	0.8%
SFCLWR		16	9.2	1.7%	0.9%	2.7%	2.6%
SKAMAN		13	7.5	1.4%	0.7%	2.2%	2.1%
UPSALM		12	6.9	1.3%	0.6%	2.1%	1.9%

Table 7. The percentage of clipped hatchery origin fish by stock using all clipped and unclipped sampled fish (Percent by stock –all) and the percent of 1-ocean fish in each clipped PBT assigned stock from the Pound Net, August 26 to October 9, 2020. Stock estimates may not equal the sum of their BY components due to rounding error.

Stock	Sample size		Percent by stock -all			Percent 1-ocean
	Actual	Adjusted	Estimate	90% lci	90% uci	
<b><u>Mid-C basin</u></b>	<b>3</b>	<b>3.01</b>	<b>0.6%</b>	<b>0.2%</b>	<b>1.1%</b>	<b>0%</b>
Deschutes	3	3.01	0.6%	0.2%	1.1%	0%
<b><u>Snake basin</u></b>	<b>310</b>	<b>329.27</b>	<b>61.0%</b>	<b>57.3%</b>	<b>64.7%</b>	<b>19.1%</b>
Dwor-C	155	167.67	31.1%	27.6%	34.6%	2.6%
Dwor-S	8	8.11	1.5%	0.8%	2.4%	0%
Imnaha	5	5.73	1.1%	0.4%	1.9%	40.0%
Oxbow	11	13.29	2.5%	1.3%	3.8%	81.8%
Pahsimeroi	22	22.57	4.2%	2.8%	5.7%	54.5%
Sawtooth	26	26.79	5.0%	3.4%	6.6%	26.9%
SF Clearwater	54	54.30	10.1%	8.0%	12.3%	7.4%
Tucannon	2	2.24	0.4%	0.0%	1.0%	100.0%
Upper Salmon	1	1.00	0.2%	0.0%	0.6%	0%
Wallowa-OR	12	12.36	2.3%	1.3%	3.4%	50.0%
Wallowa-WA	14	15.22	2.8%	1.6%	4.1%	85.7%
<b><u>Up-C basin</u></b>	<b>3</b>	<b>3.13</b>	<b>0.6%</b>	<b>0.2%</b>	<b>1.2%</b>	<b>33.1%</b>
Methow	1	1.04	0.2%	0.0%	0.6%	100.0%
Wells	2	2.09	0.4%	0.0%	1.0%	0%
<b>PBT Unassigned</b>	<b>46.0</b>	<b>26.59</b>	<b>4.9%</b>	<b>2.9%</b>	<b>7.1%</b>	na

Table 8. The number of all clipped fish and large clipped fish sampled by stock and the maximum likelihood (ML) estimate of the percentage of the large fish from each stock and the percentage of fish within each stock that were large that were collected in the Pound Net, August 26 to October 9, 2020.

Stock	Actual number sampled	Actual number of large fish	ML percent of total large	ML total 90% lci	ML total 90% uci	ML percent large within stock	ML within 90% lci	ML within 90% uci
<b><u>Hatchery clipped assigned with PBT</u></b>								
<b><i>All PBT</i></b>	<b>316</b>	<b>145</b>	<b>96.5%</b>	<b>92.4%</b>	<b>99.4%</b>	--	--	--
Deschutes	3	0	0%	0%	0%	0%	0%	0%
Dwor-C	155	106	72.0%	65.3%	78.1%	68.5%	62.6%	74.6%
Dwor-S	8	3	1.9%	0.5%	3.9%	37.5%	7.1%	66.8%
Imnaha	5	0	0%	0%	0%	0%	0%	0%
Oxbow	11	0	0%	0%	0%	0%	0%	0%
Pahsimeroi	22	0	0%	0%	0%	0%	0%	0%
Sawtooth	26	0	0%	0%	0%	0%	0%	0%
SF Clearwater	54	36	22.6%	17.2%	28.2%	66.3%	55.6%	76.6%
Tucannon	2	0	0%	0%	0%	0%	0%	0%
Upper Salmon	1	0	0%	0%	0%	0%	0%	0%
Wallowa-OR	12	0	0%	0%	0%	0%	0%	0%
Wallowa-WA	14	0	0%	0%	0%	0%	0%	0%
Methow	1	0	0%	0%	0%	0%	0%	0%
Wells	2	0	0%	0%	0%	0%	0%	0%
<b><u>Hatchery clipped assigned with GSI</u></b>								
<b><i>All GSI</i></b>	<b>46</b>	<b>14</b>	<b>3.5%</b>	<b>0.6%</b>	<b>7.6%</b>	--	--	--
MGILCS	5	2	1.2%	0%	2.9%	76.8%	0%	100.0%
SFCLWR	16	12	2.2%	0%	6.1%	100.0%	0%	100.0%
SKAMAN	13	0	0%	0%	0%	0%	0%	0%
UPSALM	12	0	0%	0%	0%	0%	0%	0%

Table 9. The percentage of unclipped hatchery origin fish (HNC) by stock and brood year (BY) and the percentage of unclipped wild origin fish by stock using all clipped and unclipped sampled fish (Percent by stock/BY --all) and the group's percentage of the hatchery unclipped fish (Percent of HNC) and wild fish (Percent of W) sampled in the Pound Net, August 26 to October 9, 2020.

Stock	BY	Sample size		Percent by stock and BY--all			Percent of HNC or W
		Actual	Adjust	Estimate	90% lci	90% uci	
<u>Unclipped hatchery origin</u>							
<i>All HNC</i>		<b>74</b>	<b>75.30</b>	<b>13.9%</b>	<b>11.5%</b>	<b>16.5%</b>	--
Dwor-C	2017	16	16.98	3.1%	1.9%	4.5%	22.5%
Dwor-C	2018	1	1.17	0.2%	0.0%	0.6%	1.6%
Pahsimeroi	2017	1	1.03	0.2%	0.0%	0.6%	1.4%
Sawtooth	2017	1	1.01	0.2%	0.0%	0.6%	1.3%
Sawtooth	2018	1	1.10	0.2%	0.0%	0.6%	1.5%
SF Clearwater	2017	36	36.00	6.7%	5.0%	8.5%	47.8%
SF Clearwater	2018	2	2.00	0.4%	0.0%	0.9%	2.7%
Upper Salmon	2017	15	15.00	2.8%	1.7%	4.1%	19.9%
Wallowa-OR	2017	1	1.02	0.2%	0.0%	0.6%	1.4%
<u>Wild origin</u>							
<i>All Wild</i>	--	<b>104</b>	<b>102.70</b>	<b>19.0%</b>	<b>16.2%</b>	<b>21.9%</b>	--
KLICKR	--	3	3.0	0.6%	0.0%	1.1%	2.9%
LOWCOL	--	1	1.0	0.2%	0.0%	0.6%	1.0%
MFSALM	--	10	10.0	1.9%	0.9%	2.8%	9.7%
MGILCS	--	23	23.0	4.3%	3.0%	5.7%	22.4%
SFCLWR	--	29	27.9	5.2%	3.6%	6.8%	27.1%
SFSALM	--	8	8.0	1.5%	0.7%	2.4%	7.8%
SKAMAN	--	6	6.0	1.1%	0.4%	1.9%	5.8%
UPCLWR	--	16	16.0	3.0%	1.9%	4.3%	15.6%
UPSALM	--	7	6.9	1.3%	0.5%	2.2%	6.7%
WILLAM	--	1	1.0	0.2%	0.0%	0.6%	1.0%

Table 10. The number of all unclipped fish and large unclipped fish sampled by stock and the maximum likelihood (ML) estimate of the percentage of the large fish from each stock and the percentage of fish within each stock that were large that were collected in the Pound Net. All fish were collected from August 26 to October 9, 2020.

Stock	Actual number sampled	Actual number of large fish	ML percent of total large	ML total 90% lci	ML total 90% uci	ML percent large within stock	ML within 90% lci	ML within 90% uci
<b><u>Hatchery unclipped</u></b>								
<b><i>All HNC</i></b>	<b>74</b>	<b>22</b>	<b>53.3%</b>	<b>40.1%</b>	<b>66.0%</b>	--	--	--
Dwor-C	17	3	8.0%	0.0%	16.0%	18.6%	0%	36.3%
Pahsimeroi	1	0	0.0%	0.0%	0.0%	0%	0%	0%
Sawtooth	2	0	0.0%	0.0%	0.0%	0%	0%	0%
SF Clearwater	38	15	35.7%	23.7%	48.5%	39.5%	26.5%	52.9%
Upper Salmon	15	4	9.5%	2.5%	17.5%	26.7%	7.7%	46.7%
Wallowa-OR	1	0	0.0%	0.0%	0.0%	0%	0%	0%
<b><u>Wild</u></b>								
<b><i>All Wild</i></b>	<b>104</b>	<b>20</b>	<b>46.7%</b>	<b>34.0%</b>	<b>59.9%</b>	--	--	--
WILLAM	1	0	0.0%	0.0%	0.0%	33.3%	0%	100.0%
KLICKR	3	1	2.4%	0.0%	7.0%	0%	0%	0%
LOWCOL	1	0	0.0%	0.0%	0.0%	20.0%	0%	44.4%
MFSALM	10	2	4.8%	0.0%	10.8%	8.7%	0%	19.4%
MGILCS	23	2	4.8%	0.0%	10.6%	20.2%	7.5%	33.8%
SFCLWR	29	6	13.4%	4.8%	22.8%	25.0%	0.0%	54.1%
SFSALM	8	2	4.8%	0.0%	10.9%	16.7%	0.0%	50.0%
SKAMAN	6	1	2.4%	0.0%	6.8%	37.5%	17.6%	58.3%
UPCLWR	16	6	14.3%	5.9%	23.5%	0%	0%	0%
UPSALM	7	0	0.0%	0.0%	0.0%	0%	0%	0%

Table 11. All distinct PBT release groups with their stock assignment, basin assignment, brood year (BY), and tagrate that were sampled in the Lower Snake River sport fishery from September 1 to December 31, 2020. The GSI stock assignment was used for fish that were not assigned to a PBT release group.

<b>PBT release group</b>	<b>Stock</b>	<b>Basin</b>	<b>BY</b>	<b>Tagrate</b>
2017-CLWH-SFCR-MeadowCr-AdClip	SF Clearwater	Snake	2017	1
2017-CLWH-SFCR-RedHouse-AdClip	SF Clearwater	Snake	2017	1
2017-DWOR-DWOR-ClearCr-AdClip	Dwor-C	Snake	2017	0.9792
2017-DWOR-DWOR-NFClearwaterR-AdClip	Dwor-C	Snake	2017	0.8909
2017-DWOR-DWOR-RedHouse-AdClip	Dwor-C	Snake	2017	0.9625
2017-HNFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2017	0.9926
2017-IRRI-IMNA-Imnaha	Imnaha	Snake	2017	0.9394
2017-IRRI-WALL-GrandeRondeR/WallowaR	Wallowa-OR	Snake	2017	0.9831
2017-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2017	0.9836
2017-MVFH-DWOR-YankeeForkR-AdClip	Dwor-S	Snake	2017	0.9863
2017-MVFH-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2017	0.9884
2017-MVFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2017	1
2017-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2017	0.5472
2017-NIAG-PAHS-PahsimeroiR-AdClip	Pahsimeroi	Snake	2017	0.9697
2018-HNFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2018	0.9086
2018-IRRI-WALL-WallowaR	Wallowa-OR	Snake	2018	0.9597
2018-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2018	0.9098
2018-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2018	0.9344
2018-NIAG-PAHS-PahsimeroiR-AdClip	Pahsimeroi	Snake	2018	0.9789
Unassigned	SFCLWR	Snake	na	na
Unassigned	UPSALM	Snake	na	na

Table 12. Stock composition estimates by stock and brood year (BY) in the Lower Snake River sport fishery from September 1 to December 31, 2020. All fish were adipose clipped. The GSI assignment was used for fish that did not assigned to a PBT release group.

Stock	BY	Sample size		Percent by stock and BY		
		Actual	Adjust	Estimate	90% lci	90% uci
<b><i>All PBT assigned</i></b>		<b>81</b>	<b>85.29</b>	<b>89.8%</b>	<b>83.0%</b>	<b>96.1%</b>
Dwor-C	2017	21	22.98	24.2%	17.0%	32.2%
Dwor-S	2017	2	2.03	2.1%	0.0%	4.3%
Imnaha	2017	3	3.19	3.4%	1.1%	6.7%
Oxbow	2017	1	1.83	1.9%	0.0%	5.8%
Oxbow	2018	2	2.14	2.3%	0.0%	4.6%
Pahsimeroi	2017	6	6.15	6.5%	2.2%	10.8%
Pahsimeroi	2018	1	1.02	1.1%	0.0%	3.2%
Sawtooth	2017	8	8.05	8.5%	4.2%	13.8%
Sawtooth	2018	2	2.20	2.3%	0.0%	4.6%
SF Clearwater	2017	5	5.00	5.3%	2.1%	9.5%
Wallowa-OR	2017	6	6.10	6.4%	2.1%	10.7%
Wallowa-OR	2018	1	1.04	1.1%	0.0%	3.3%
Wallowa-WA	2017	21	21.35	22.5%	16.1%	30.0%
Wallowa-WA	2018	2	2.20	2.3%	0.0%	5.8%
<b><u>Hatchery origin GSI assigned</u></b>						
<b><i>All GSI assigned</i></b>		<b>14</b>	<b>9.71</b>	<b>10.2%</b>	<b>3.9%</b>	<b>17.0%</b>
SFCLWR		6	4.16	4.4%	1.2%	8.4%
UPSALM		8	5.55	5.8%	1.9%	10.5%

Table 13. Stock composition estimates in the Lower Snake River sport fishery, September 1 to December 31, 2020. The GSI assignment was used for fish that did not assigned to a PBT release group. Stock estimates may not equal the sum of their BY components due to rounding error.

<b>Stock</b>	<b>Sample size</b>		<b>Percent by stock</b>			<b>Percent 1-ocean</b>
	<b>Actual</b>	<b>Adjusted</b>	<b>Estimate</b>	<b>90% lci</b>	<b>90% uci</b>	
Dwor-C	21	22.98	24.2%	17.0%	32.2%	0%
Dwor-S	2	2.03	2.1%	0.0%	4.3%	0%
Imnaha	3	3.19	3.4%	1.1%	6.7%	0%
Oxbow	3	3.97	4.2%	0.0%	8.4%	66.7%
Pahsimeroi	7	7.17	7.5%	3.2%	11.9%	14.3%
Sawtooth	10	10.25	10.8%	5.4%	16.2%	20.0%
SF Clearwater	5	5.00	5.3%	2.1%	9.5%	0%
Wallowa-OR	7	7.15	7.5%	3.2%	11.9%	14.3%
Wallowa-WA	23	23.55	24.8%	17.3%	32.3%	8.7%
<b>PBT Unassigned</b>	<b>14</b>	<b>9.71</b>	<b>10.2%</b>	<b>3.9%</b>	<b>17.0%</b>	na



Table 14      The number of all fish and large fish sampled by stock and the maximum likelihood (ML) estimate of the percentage of the large fish from each stock and the percentage of fish within each stock that were large that were sampled in the Lower Snake River sport fishery from September 1 to December 31, 2020.

<b>Stock</b>	<b>Actual number sampled</b>	<b>Actual number of large fish</b>	<b>ML percent of total large</b>	<b>ML total 90% lci</b>	<b>ML total 90% uci</b>	<b>ML percent large within stock</b>	<b>ML within 90% lci</b>	<b>ML within 90% uci</b>
Dwor-C	21	16	67.2%	49.6%	84.2%	76.0%	60.3%	91.2%
Dwor-S	2	1	3.9%	0%	11.3%	50.0%	0%	100%
Imnaha	3	0	0%	0%	0%	0%	0%	0%
Oxbow	3	0	0%	0%	0%	0%	0%	0%
Pahsimeroi	7	1	3.8%	0%	10.7%	14.0%	0%	39.6%
Sawtooth	10	0	0%	0%	0%	0%	0%	0%
SF Clearwater	5	3	11.5%	2.9%	22.6%	60.0%	16.7%	100%
Wallowa-OR	7	0	0%	0%	0%	0%	0%	0%
Wallowa-WA	23	0	0%	0%	0%	0%	0%	0%
<b><u>Hatchery clipped assigned with GSI</u></b>								
SFCLWR	6	5	13.5%	0.5%	28.0%	88.5%	32%	100%
UPSALM	8	0	0%	0%	0%	0%	0%	0%

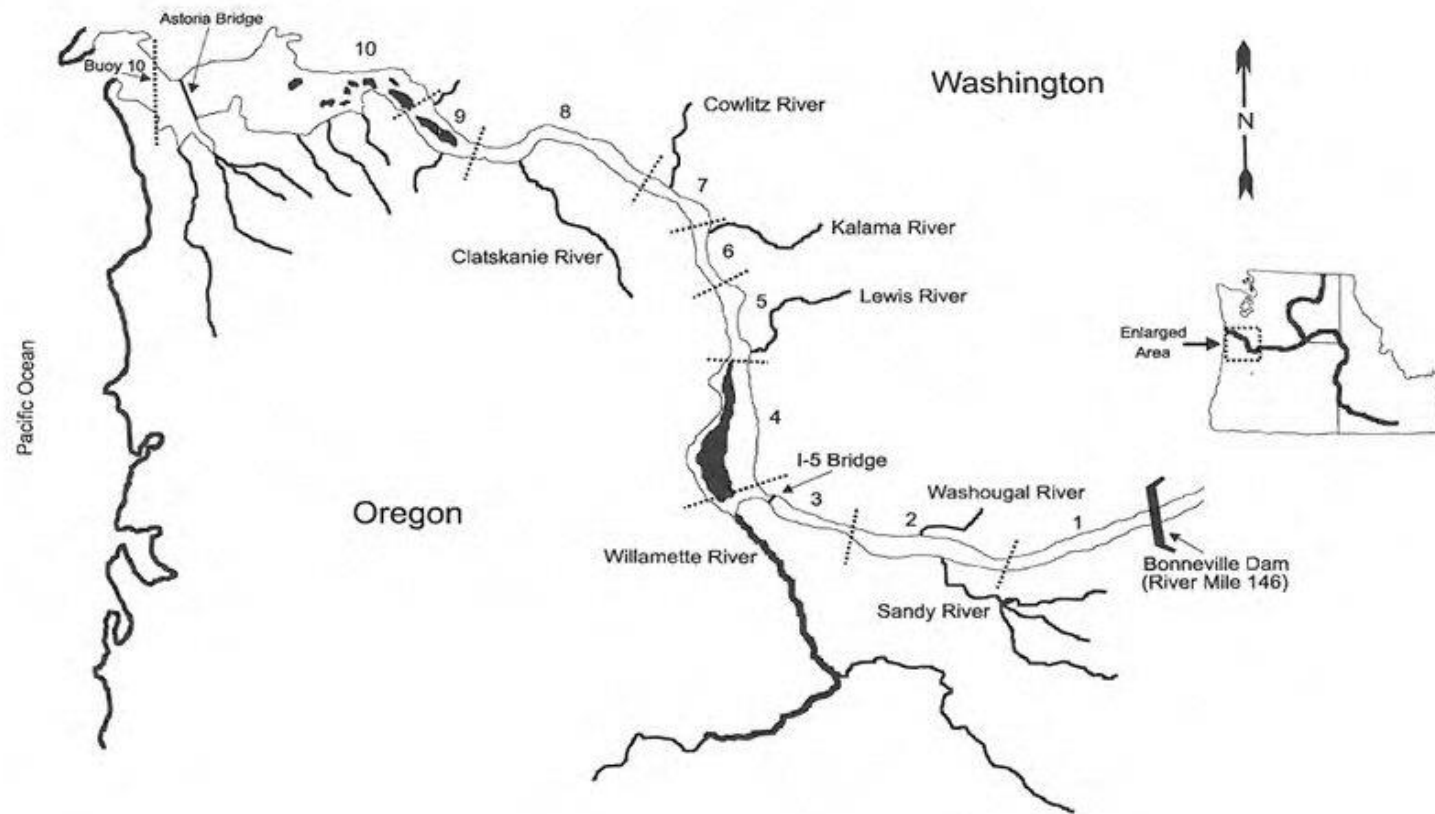


Figure 1. Map of the Lower Columbia River showing the 10 creel survey sections that were used to estimate sport harvest.

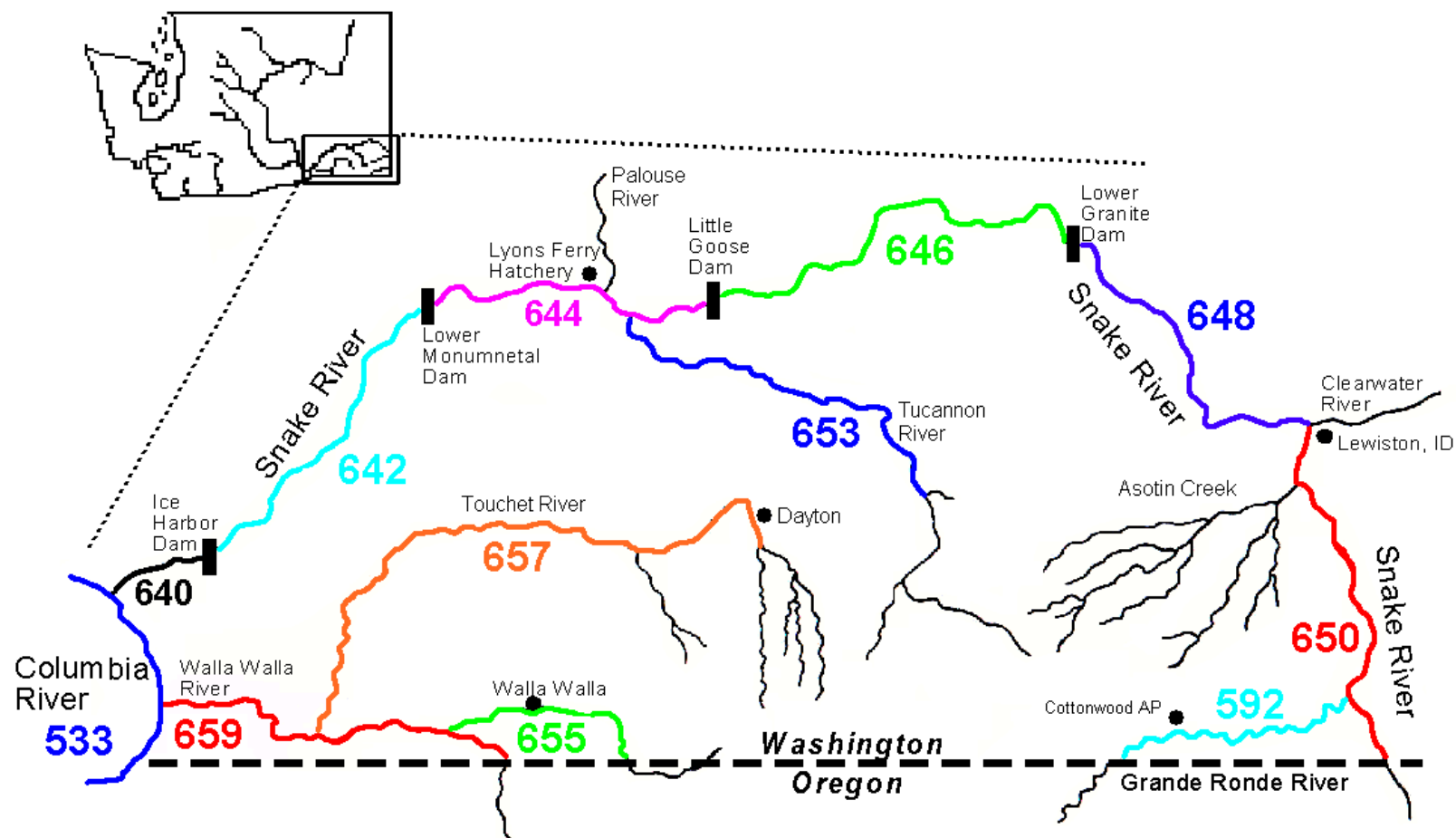


Figure 2. Washington Department of Fish and Wildlife harvest zones in the Snake and Walla Walla basins that are used to estimate steelhead harvest.

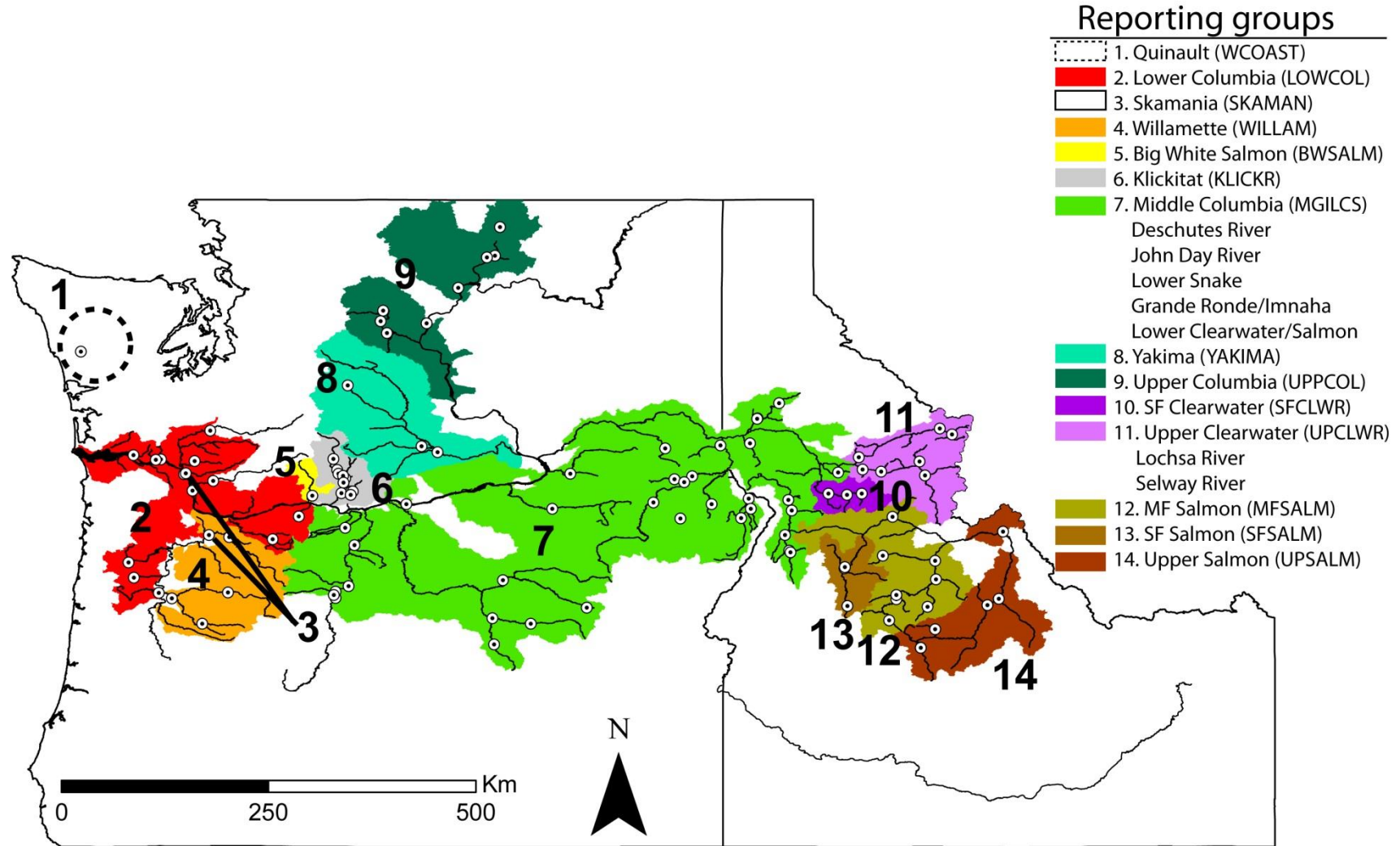


Figure 3. Map of the GSI reporting groups that were developed by CRITFC. These groups were used to assign adipose clipped and adipose unclipped steelhead that were not identified with PBT.

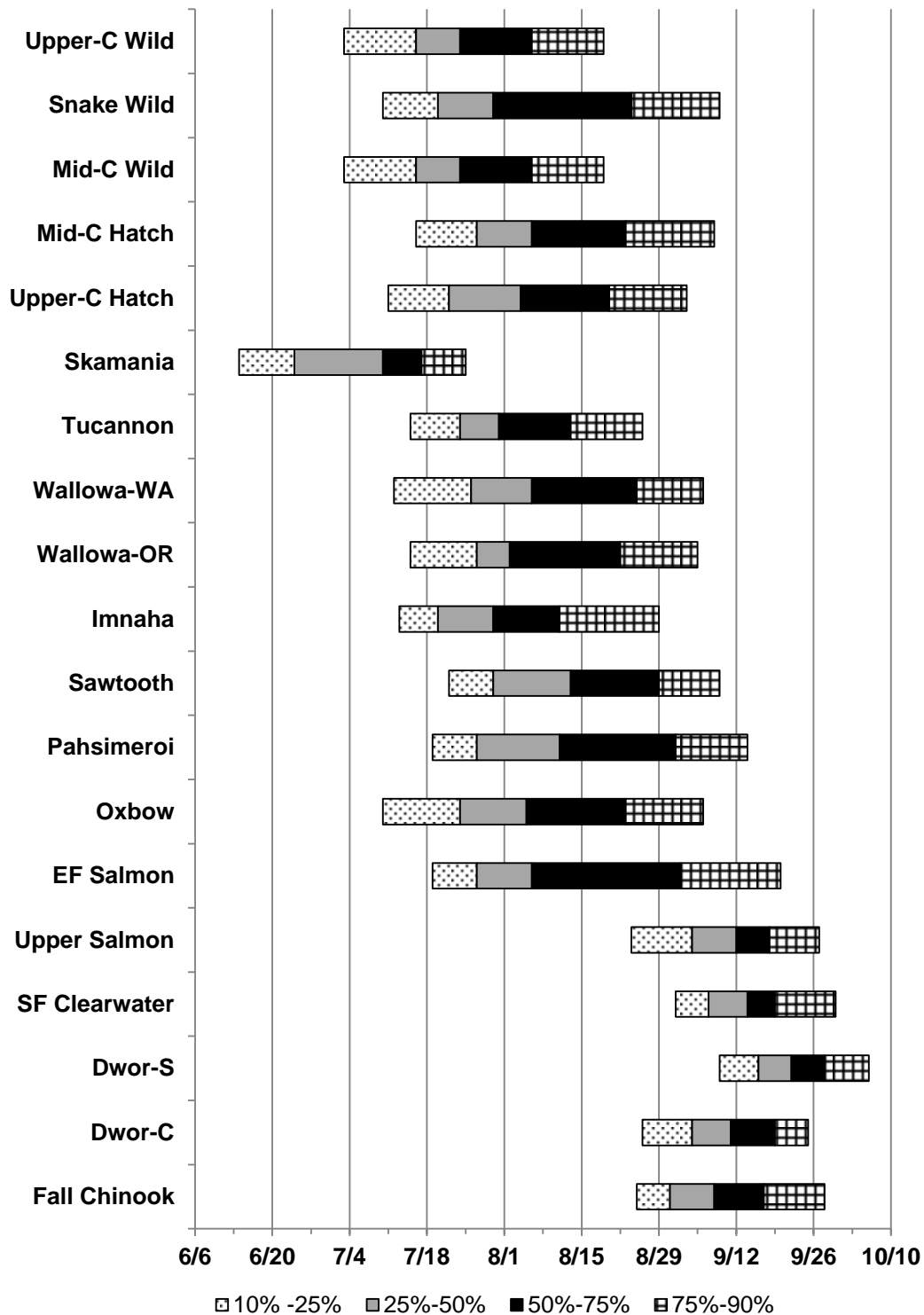


Figure 4 Run-timing of fall Chinook and hatchery and wild steelhead stocks at Bonneville Dam in 2020. The Skamania stock is for fish released in the Klickitat River. The Snake River wild stock excludes fish tagged at Snake River dams.

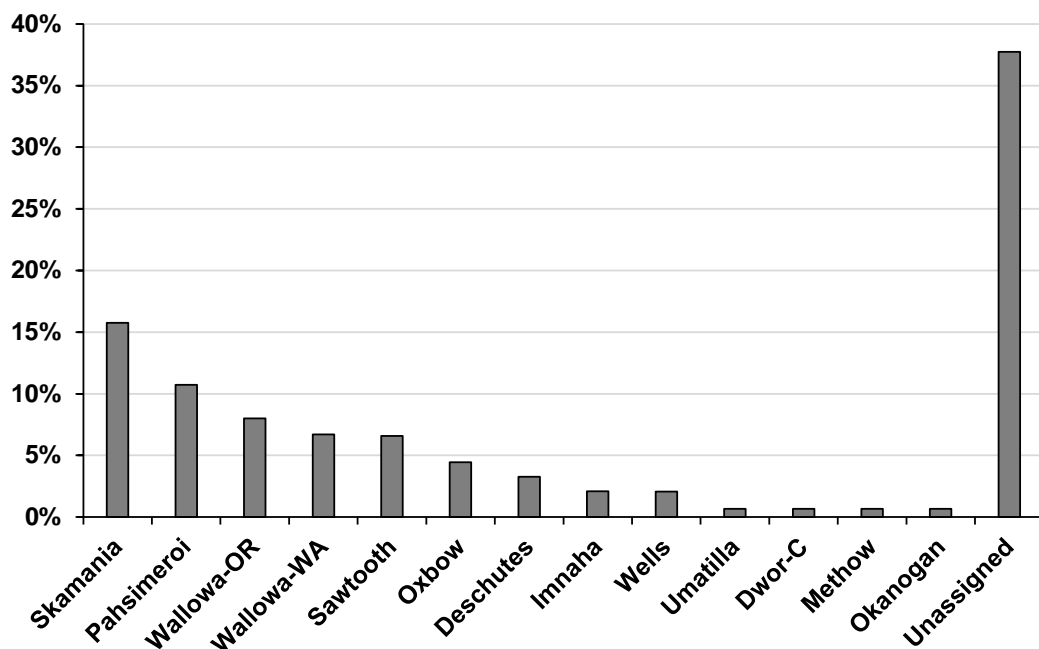


Figure 5. Hatchery stock composition in the Lower Columbia River sport fishery, June 16 to July 31, 2020.

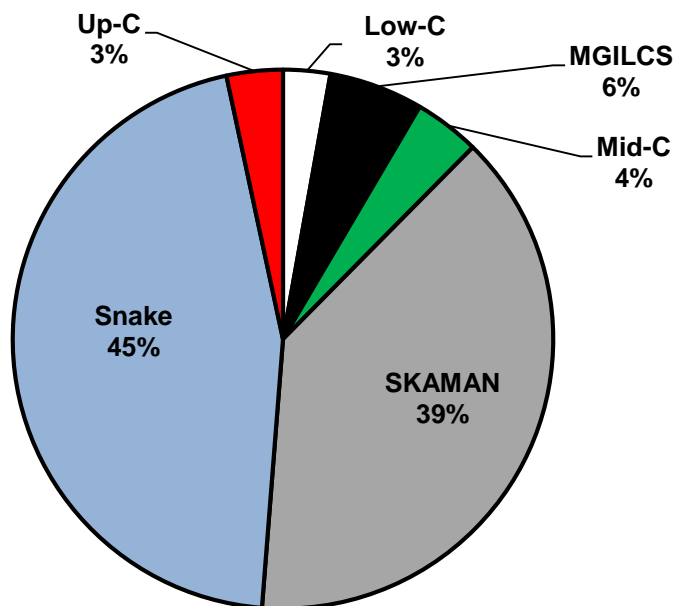


Figure 6. Harvest contribution by basin in the Lower Columbia River sport fishery, June 16 to July 31, 2020.

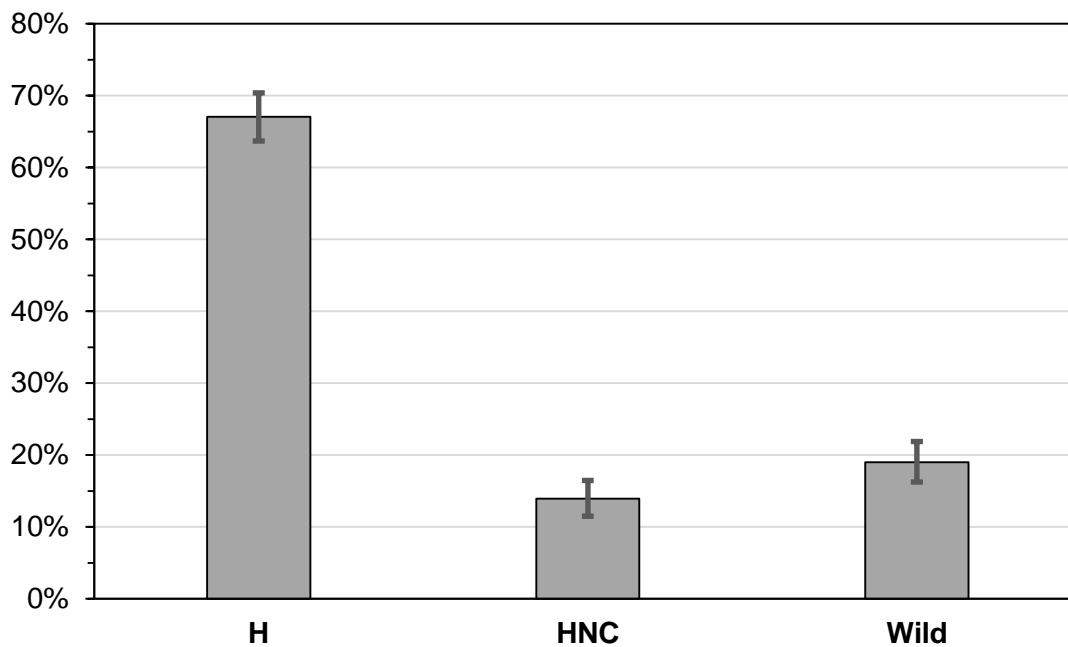


Figure 7. The percentage and 90% confidence intervals of clipped hatchery (H), unclipped hatchery (HNC), and unclipped wild origin fish sampled in the Pound Net in 2020.

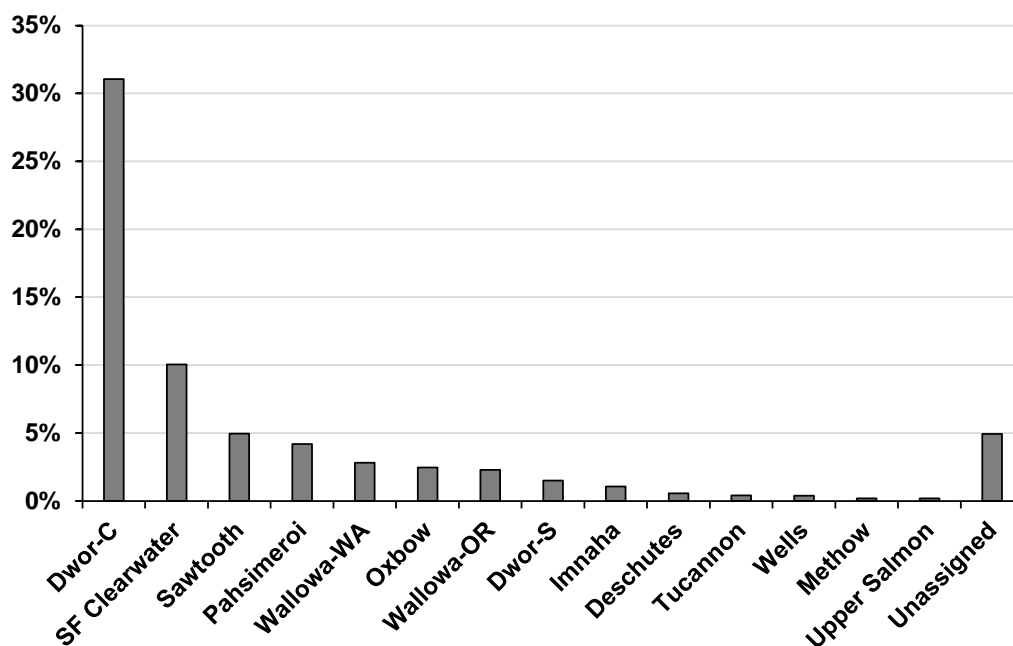


Figure 8. Stock composition of clipped hatchery origin fish sampled in the Pound Net in 2020. Clipped hatchery origin fish made up 67% of the sampled fish.

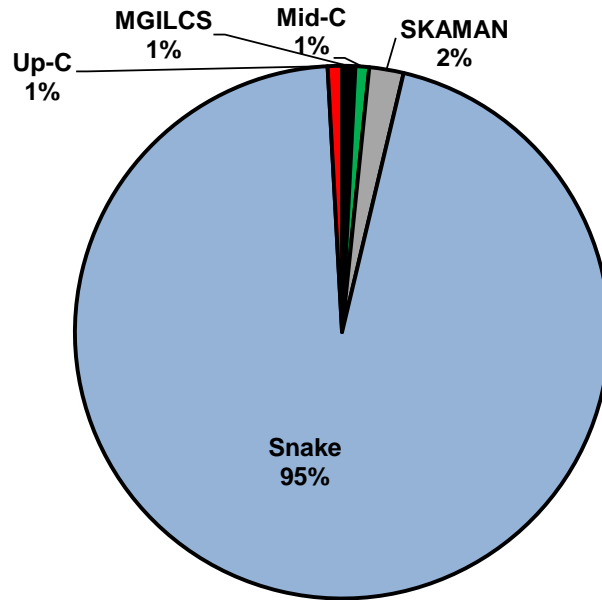


Figure 9. Stock contribution by basin of the clipped hatchery origin fish sampled in the Pound net in 2020.

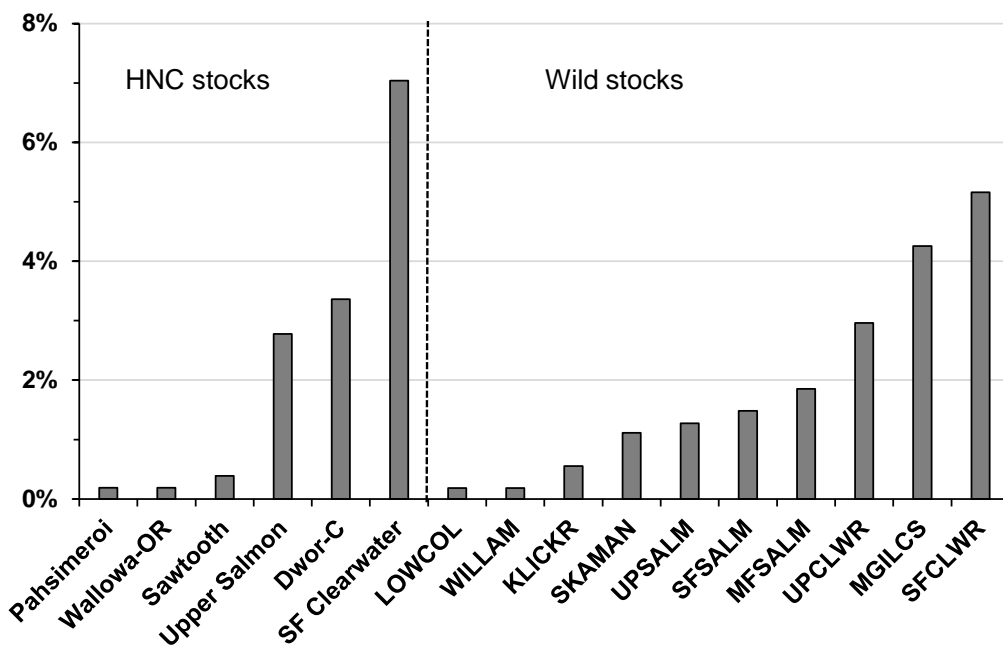


Figure 10. Stock composition of unclipped fish sampled in the Pound Net in 2020. Unclipped hatchery origin (HNC) and wild fish made up 14% and 19% of the sampled fish, respectively.



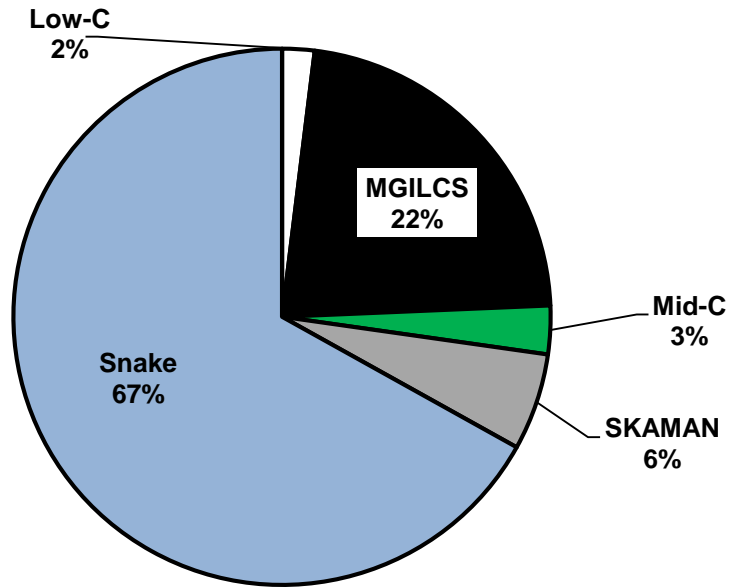


Figure 11. The percentage by basin of wild steelhead that were sampled in the Pound Net in 2020. Wild steelhead made up 19% of the total fish sampled.

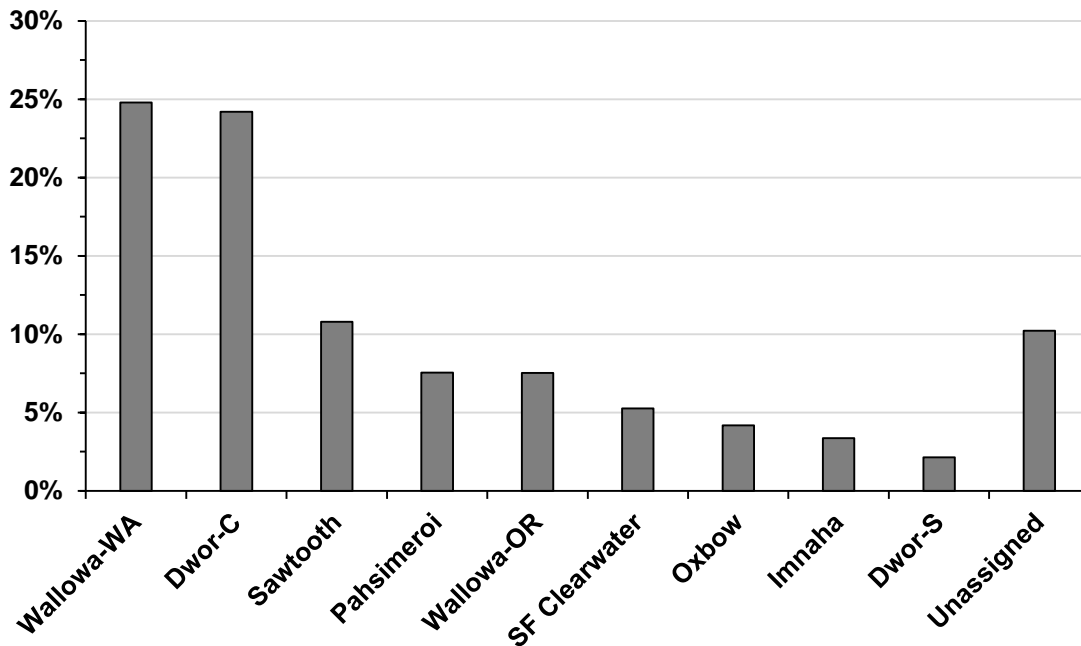


Figure 12. Hatchery stock composition in the Lower Snake River sport fishery, September 1 to December 31, 2020.

Appendix A. Date of arrival at Bonneville Dam of summer steelhead stocks and fall Chinook in 2020. The Pound Net passage column is the percentage of the stock's passage that occurred at Bonneville Dam from August 28 to October 9, 2020. The stocks shaded in grey contribute most of the large hatchery origin steelhead during the A/B-Index steelhead passage period at Bonneville Dam.

Stock	Number	Date arrival quantile attained at Bonneville Dam							Pound Net passage
		5%	10%	25%	50%	75%	90%	95%	
Fall Chinook	391,959	8/19	8/25	8/31	9/8	9/17	9/28	10/5	82%
Dwor-C	157	8/20	8/26	9/4	9/11	9/19	9/25	10/1	85%
Dwor-S	35	9/3	9/9	9/16	9/22	9/28	10/6	10/10	91%
SF Clearwater	160	8/26	9/1	9/7	9/14	9/19	9/30	10/2	90%
Upper Salmon	35	8/22	8/24	9/4	9/12	9/18	9/27	9/29	83%
EF Salmon	28	7/15	7/19	7/27	8/6	9/2	9/20	9/21	29%
Oxbow	71	7/3	7/10	7/24	8/5	8/23	9/6	9/14	20%
Pahsimeroi	64	7/11	7/19	7/27	8/11	9/1	9/14	9/22	27%
Sawtooth	121	7/12	7/22	7/30	8/13	8/29	9/9	9/18	25%
Imnaha	95	7/11	7/13	7/20	7/30	8/11	8/29	9/8	12%
Wallowa-OR	96	7/7	7/15	7/27	8/2	8/22	9/5	9/11	18%
Wallowa-WA	137	7/9	7/12	7/26	8/6	8/25	9/6	9/15	18%
Tucannon	36	7/7	7/15	7/24	7/31	8/13	8/26	9/2	8%
Skamania	118	6/8	6/14	6/24	7/10	7/17	7/25	7/27	1%
Up-C Hatch	271	7/2	7/11	7/22	8/4	8/20	9/3	9/8	16%
Mid-C Hatch	46	7/11	7/16	7/27	8/6	8/23	9/8	9/16	20%
Mid-C Wild	148	6/24	7/3	7/16	7/24	8/6	8/19	9/7	6%
Snake Wild	296	7/4	7/10	7/20	7/30	8/24	9/9	9/16	24%
Up-C Wild	60	6/23	6/28	7/14	7/23	8/1	8/16	8/19	5%
MIN Snake hatchery		7/3	7/10	7/20	7/30	8/11	8/26	9/2	--
MAX Snake hatchery		9/3	9/9	9/16	9/22	9/28	10/6	10/10	--
Snake duration (days)		62	61	58	54	48	41	38	--

Appendix B. Harvest and stock composition estimates by PBT release groups in the Lower Columbia River sport fishery, June 16 to July 31, 2020. All fish were adipose clipped.

PBT Release Group	Harvest by group			Percent of harvest		
	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
2016-Skamania	65	0	195	3.25%	0.00%	9.75%
2017-Deschutes	65	26	118	3.27%	1.31%	5.89%
2017-DWOR-DWOR-ClearCr-AdClip	13	0	40	0.67%	0.00%	2.00%
2017-HNFH-SAWT-SawtoothFH-AdClip	105	53	171	5.27%	2.63%	8.56%
2017-IRRI-IMNA-Imnaha	42	14	83	2.09%	0.70%	4.17%
2017-IRRI-WALL-GrandeRondeR/WallowaR	146	80	212	7.31%	3.99%	10.64%
2017-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	119	66	186	5.98%	3.32%	9.30%
2017-Methow	13	0	39	0.65%	0.00%	1.96%
2017-MVFH-PAHS-LittleSalmonR-AdClip	13	0	40	0.66%	0.00%	1.98%
2017-MVFH-SAWT-SawtoothFH-AdClip	26	0	65	1.31%	0.00%	3.27%
2017-NIAG-OXBO-LittleSalmonR-AdClip	27	0	81	1.36%	0.00%	4.08%
2017-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	48	0	95	2.39%	0.00%	4.78%
2017-NIAG-PAHS-LittleSalmonR-AdClip	13	0	39	0.65%	0.00%	1.96%
2017-NIAG-PAHS-PahsimeroiR-AdClip	148	81	229	7.41%	4.04%	11.46%
2017-Okanogan	13	0	39	0.65%	0.00%	1.96%
2017-Skamania	250	166	347	12.51%	8.34%	17.38%
2017-Umatilla	13	0	40	0.67%	0.00%	2.02%
2017-Wells	41	14	82	2.05%	0.68%	4.11%
2018-IRRI-WALL-WallowaR	14	0	41	0.68%	0.00%	2.04%
2018-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	14	0	43	0.72%	0.00%	2.16%
2018-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	14	0	42	0.70%	0.00%	2.10%
2018-NIAG-PAHS-PahsimeroiR-AdClip	40	13	80	2.00%	0.67%	4.01%
PBT Unassigned	753	576	920	37.73%	28.85%	46.11%

Appendix C PBT release group percentages of all fish sampled in the Columbia River Pound Net in 2020. The classification (Class) is based on the adipose fin of the sampled fish and the genetic analysis not the adipose status of its PBT release group. Class H = adipose clipped hatchery origin; HNC adipose unclipped hatchery origin; W = adipose unclipped wild origin.

<b>PBT Release Group</b>	<b>Class</b>	<b>Percent of all samples</b>	<b>90% lci</b>	<b>90% uci</b>
2017-CLWH-SFCR-MeadowCr-AdClip	H	7.22%	5.37%	9.07%
2017-CLWH-SFCR-NewsomeCr-NoClip	H	0.19%	0.00%	0.56%
2017-CLWH-SFCR-RedHouse-AdClip	H	1.85%	0.93%	2.78%
2017-Deschutes	H	0.56%	0.19%	1.11%
2017-DWOR-DWOR-ClearCr-AdClip	H	5.11%	3.59%	6.81%
2017-DWOR-DWOR-NFClearwaterR-AdClip	H	16.42%	13.72%	19.33%
2017-DWOR-DWOR-RedHouse-AdClip	H	8.66%	6.73%	10.77%
2017-HNFH-SAWT-SawtoothFH-AdClip	H	2.43%	1.31%	3.54%
2017-IRRI-IMNA-Imnaha	H	0.59%	0.20%	1.18%
2017-IRRI-WALL-GrandeRondeR/WallowaR	H	1.13%	0.38%	1.88%
2017-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	H	0.38%	0.00%	0.94%
2017-MVFH-DWOR-YankeeForkR-AdClip	H	1.50%	0.75%	2.44%
2017-MVFH-PAHS-LittleSalmonR-AdClip	H	0.56%	0.19%	1.12%
2017-MVFH-SAWT-SawtoothFH-AdClip	H	1.11%	0.37%	1.85%
2017-MVFH-USAL-YankeeForkSalmonR-NoClip	H	0.19%	0.00%	0.56%
2017-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	H	0.68%	0.00%	1.35%
2017-NIAG-PAHS-LittleSalmonR-AdClip	H	0.19%	0.00%	0.56%
2017-NIAG-PAHS-PahsimeroiR-AdClip	H	1.15%	0.38%	1.91%
2017-Wells	H	0.39%	0.00%	0.97%
2018-CLWH-SFCR-MeadowCr-AdClip	H	0.60%	0.20%	1.19%
2018-CLWH-SFCR-RedHouse-AdClip	H	0.20%	0.00%	0.60%
2018-DWOR-DWOR-NFClearwaterR-AdClip	H	0.86%	0.22%	1.73%

## Appendix C (continued)

PBT Release Group	Class	Percent of		
		all samples	90% lci	90% uci
2018-HNFH-SAWT-SawtoothFH-AdClip	H	1.22%	0.41%	2.04%
2018-IRRI-IMNA-Imnaha	H	0.47%	0.00%	1.17%
2018-IRRI-WALL-WallowaR	H	1.16%	0.39%	1.93%
2018-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	H	2.44%	1.42%	3.66%
2018-LYON-TUCA-TucannonR-WA	H	0.41%	0.00%	1.04%
2018-Methow	H	0.19%	0.00%	0.58%
2018-MVFH-SAWT-SawtoothFH-AdClip	H	0.20%	0.00%	0.60%
2018-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	H	1.78%	0.79%	2.77%
2018-NIAG-PAHS-LittleSalmonR-AdClip	H	0.21%	0.00%	0.62%
2018-NIAG-PAHS-PahsimeroiR-AdClip	H	2.08%	1.14%	3.22%
Unassigned	H	4.92%	2.90%	7.07%
2017-CLWH-SFCR-MeadowCr-AdClip	HNC	0.74%	0.19%	1.48%
2017-CLWH-SFCR-MeadowCr-NoClip	HNC	3.15%	2.04%	4.44%
2017-CLWH-SFCR-NewsomeCr-NoClip	HNC	2.59%	1.48%	3.70%
2017-CLWH-SFCR-RedHouse-AdClip	HNC	0.19%	0.00%	0.56%
2017-DWOR-DWOR-LoloCr-NoClip	HNC	1.48%	0.74%	2.41%
2017-DWOR-DWOR-NFClearwaterR-AdClip	HNC	1.66%	0.83%	2.70%
2017-HNFH-SAWT-SawtoothFH-AdClip	HNC	0.19%	0.00%	0.56%
2017-IRRI-WALL-GrandeRondeR/WallowaR	HNC	0.19%	0.00%	0.57%
2017-MVFH-USAL-PahsimeroiR-NoClip	HNC	1.48%	0.74%	2.41%
2017-MVFH-USAL-YankeeForkSalmonR-NoClip	HNC	1.30%	0.56%	2.04%
2017-NIAG-PAHS-PahsimeroiR-AdClip	HNC	0.19%	0.00%	0.57%
2018-CLWH-SFCR-NewsomeCr-NoClip	HNC	0.37%	0.00%	0.93%
2018-DWOR-DWOR-NFClearwaterR-AdClip	HNC	0.22%	0.00%	0.65%
2018-HNFH-SAWT-SawtoothFH-AdClip	HNC	0.20%	0.00%	0.61%
All Wild GSI stocks	W	19.0%	16.2%	21.9%

Appendix D. PBT Release group percentages for the Lower Snake Sport 2020 fishery. Harvest estimates were not available at the time the report was compiled. All fish were adipose clipped.

<b>PBT Release Group</b>	<b>Percent</b>	<b>90% Ici</b>	<b>90% uci</b>
2017-CLWH-SFCR-MeadowCr-AdClip	2.11%	0.00%	5.26%
2017-CLWH-SFCR-RedHouse-AdClip	3.16%	1.05%	6.32%
2017-DWOR-DWOR-ClearCr-AdClip	5.37%	2.15%	9.67%
2017-DWOR-DWOR-NFClearwaterR-AdClip	17.72%	10.63%	24.81%
2017-DWOR-DWOR-RedHouse-AdClip	1.09%	0.00%	3.28%
2017-HNFH-SAWT-SawtoothFH-AdClip	7.42%	3.18%	11.67%
2017-IRRI-IMNA-Imnaha	3.36%	1.12%	6.72%
2017-IRRI-WALL-GrandeRondeR/WallowaR	6.42%	2.14%	10.71%
2017-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	22.47%	16.05%	29.97%
2017-MVFH-DWOR-YankeeForkR-AdClip	2.13%	0.00%	4.27%
2017-MVFH-PAHS-LittleSalmonR-AdClip	2.13%	0.00%	5.32%
2017-MVFH-SAWT-SawtoothFH-AdClip	1.05%	0.00%	3.16%
2017-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	1.92%	0.00%	5.77%
2017-NIAG-PAHS-PahsimeroiR-AdClip	4.34%	1.09%	7.65%
2018-HNFH-SAWT-SawtoothFH-AdClip	2.32%	0.00%	4.63%
2018-IRRI-WALL-WallowaR	1.10%	0.00%	3.29%
2018-LYON-CGRW-CottonWoodGR/WallowaR/LyonsFerry/Touchet-WA	2.31%	0.00%	5.78%
2018-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	2.25%	0.00%	4.56%
2018-NIAG-PAHS-PahsimeroiR-AdClip	1.08%	0.00%	3.23%
Unassigned	10.22%	3.88%	16.96%

**Prepared By:**

Alan Byrne  
Idaho Department of Fish and Game  
600 S Walnut St.  
Boise, ID 83707

Thomas Delomas  
Pacific States Marine Fisheries Commission  
Eagle Genetics Lab  
1800 Trout Rd.  
Eagle, ID 83616

Ken Keller  
Pacific States Marine Fisheries Commission  
5525 S 11<sup>th</sup> St.  
Ridgefield, WA 98642

Bonnie Jackman  
Pacific States Marine Fisheries Commission  
5525 S 11<sup>th</sup> St.  
Ridgefield, WA 98642

Jeremy Trump  
Washington Department of Fish and Game  
401 South Cottonwood Street  
Dayton, WA 99328

**Approved By:**

Idaho Department Of Fish And Game

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Anadromous Program Manager



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J. Lance Hebdon  
Chief of Fisheries